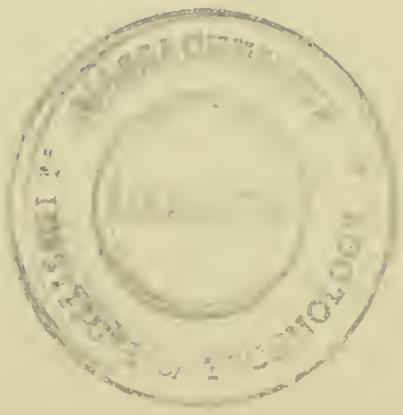

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EXTERNAL COMMUNICATION AND PROJECT PERFORMANCE: AN INVESTIGATION INTO THE ROLE OF GATEKEEPERS

Ralph Katz and Michael L. Tushman

WP 1075-79 July 1979

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ABSTRACT

Research findings from many disciplines indicate that certain boundary spanning individuals, labelled gatekeepers, are an important linking mechanism between organizations and their external environments. This study investigates explicitly the role of gatekeepers in the transfer and flow of information within an R&D setting by comparing directly the performance ratings of subunits (i.e., projects) with and without gatekeepers. Basically, the results confirm that gatekeepers execute a vital and effective role by channeling external information into their subunits; but only for those subunits performing tasks that are "locally defined." For more "universally defined" tasks, the gatekeeping function was inversely related to subunit performance. These results were also substantiated across different environmental conditions. Evidence suggests that gatekeepers do more than mediate external technology and information; they appear to facilitate more effective communication for their other subunit colleagues. Direct interpersonal contact and contact mediated by gatekeepers, therefore, are two contrasting ways to link subunits with external areas. The relative effectiveness of these linking mechanisms is contingent on the nature of the unit's work.

Oral communication networks represent important structures through which information is gathered, transferred, and processed within organizations (March and Simon, 1957; Boorman, 1978; Tichy, 1980). Communication networks are themselves characterized by a number of interrelated components, including the amount and direction of communication linkages, the degree of centralization, the distribution of communication nodes and clusters, or some other measure of connectedness or segmentation (Tushman and Nadler, 1980; MacKenzie, 1978). The research reported here focuses primarily on the gatekeeping function within communication structures. Gatekeepers are those key individuals who are both strongly connected to internal colleagues and strongly linked to external domains.[1] More specifically, we will investigate the relationships between the existence of gatekeepers and subunit performance for different types of tasks. Such comparative results will hopefully increase our understanding of the role played by gatekeepers in the effective utilization of external technology and information.

LITERATURE REVIEW AND HYPOTHESES

Gatekeepers: The Phenomenon

Social systems must be able to gather and process information from external areas in order to make effective decisions (Thompson, 1967; March and Simon, 1957). Complete information processing, however, would be rather expensive and extremely time consuming. (Arrow, 1974). One way to deal with the costs and limitations of information processing is through specialization; specialized subunits evolving to deal with

relatively homogenous sets of task activities and segments of the system's work environment (Katz and Kahn, 1966; Thompson, 1967). Such differentiation is, in turn, associated with the development of more locally defined languages and orientations; that is, a locally shared semantic and cognitive field to define, label, and generally organize a complex reality (Arrow, 1974; Cherry, 1965; March and Simon, 1958). Such localized definitions and specifications gradually unfold from the constant interactions among the unit's task and technological demands, the organization's overall interests and requirements, the common social and task related experiences of unit members, and the unit's norms, values, strengths, and historical perspectives (Lewis, 1948; Kaufman, 1960; Van Maanen and Katz, 1979). These ideosyncratic developments are a basic determinant of attitudes and behaviors in that they shape how the unit's environment is enacted and how members think about and define their various problems and associated decision parameters (Miller and Johnson-Laird, 1976; Kuhn, 1962; Whorf, 1956). The tasks of a given unit, therefore, are often local in nature in that problems, strategies, and solutions are constrained by the subculture of the unit in which they are being addressed.

This local orientation and coding scheme development can be a double-edged sword. For those who share in this common language and awareness, communication is remarkably efficient. Not only can large amounts of information be transmitted with a relatively few specialized symbols, but through systematic selection and encoding rules, misinterpretations between actors are minimized (March and Simon, 1958; Allen, 1977; Triandes, 1960). Furthermore, actors who share coding schemes can effectively communicate both digitally (e.g., verbally or

through natural languages) as well as analogically (e.g., through images or non-verbally) [Watzlawick, Beavin, and Jackson, 1967].

If actors do not share a common coding scheme and technical language, their work-related communication will probably be less efficient and more costly (Dearborn and Simon, 1958; Wilensky, 1967). This lack of commonality can be conceptualized as a communication impedance. The greater this mismatch or incongruity, the greater the difficulties of communicating. Thus, communication impedance is associated with what Bar-Hillel and Carnap (1953) call semantic noise; errors in the interpretation of messages analogous to noise sources in physical systems which cause error in message reception. Communications between coding systems, or across communication boundaries, without knowledge on the part of one or both communicators of the other's coding system, may lead to misperceptions and an incomplete understanding of the information content being discussed and exchanged. (Cherry, 1965).

Thus, there seems to be a kind of catch-22. The evolution of local languages and coding schemes helps the unit deal with its local information processing requirements; yet, it also hinders the unit's effective acquisition and interpretation of information from external areas. External information is vital, however, both in terms of feedback (Ashby, 1960) and for evaluating and acting on the unit's environment (Arrow, 1978; Utterback, 1974). How, then, can units be effectively linked to external information areas?

One way to deal with the difficulties of communicating across differentiated boundaries is through gatekeepers; individuals in the communication network who are capable of understanding and translating contrasting coding schemes. With the help of these key individuals,

external information can flow into the system by means of a two-step process. First, gatekeepers are able to gather and understand external information and new technological developments, and subsequently, are able to translate this information into terms that are more meaningful and useful to their more locally oriented colleagues.

The likelihood of a two-step flow of external communication to overcome communication impedance has been described by a number of researchers in a variety of settings. For instance, communication between subunits within organizations (Schwartz and Jacobson, 1977), between R&D laboratories and external areas (Whitley and Frost, 1973), between knowledge generators and knoweldge users (Sundquist, 1978; Crane, 1972), between different components of school systems (Baldridge and Burnham, 1975), and between early and late adopters of innovation (Rodgers and Shoemaker, 1971; Coleman, Katz and Menzel, 1966), have all been shown to occur in a two-step process.

While substantial literature supports the existence of gatekeepers, there is virtually no direct evidence to support the notion that gatekeepers can enhance subunit performance. Project SAPPHO (Achelladeles, Jervis, and Robertson, 1971) and Carter and Williams, (1957) provide case studies, while Katz and Tushman (1979) and Allen, Tushman, and Lee (1979) provide only inferential support for the positive association between gatekeepers and subunit performance. The initial research question, then, investigates the association between gatekeepers and subunit performance. Is this relationship positive across all kinds of task assignments or are there some types of tasks for which subunits may be more effective if they are linked to external areas through direct contact be all subunit members? The second

research question examines the role of gatekeepers with respect to information transfer. Are gatekeepers the primary source of external information or can they also serve to make the direct external communication of their more locally oriented colleagues more effective? Specific hypotheses are developed below.[2]

Gatekeepers and Subunit Performance

The two-step flow of communication hinges on the existence of communication impedence resulting from the associated communication boundary separating the subunit from its external information areas. To the extent that different technical languages and coding schemes exist between actors, communication across this boundary will be difficult, inefficient, and prone to bias and distortion (Dearborn and Simon, 1958). Several studies for example, have found an inverse relation between extra-organizational communication and both individual and subunit performance (Allen, 1964; Baker, et. al, 1967; Shilling and Bernard, 1964; and Roberts and O'Reilly, 1979).

On the other hand, if external sources do not have different languages and coding schemes from members of the subunit, then this communication impedance will not exist. Under these conditions, external areas can provide new ideas and feedback to all unit members; and consequently, there will be a positive association between extra-unit communication and overall performance. Hagstrom (1965), for instance, found a stong positive association between the productivity of scientists and their level of external contact with colleagues from other universities.

The nature of a subunit's work, therefore, is a basic factor

affecting the development of a more localized language and orientation. Work which is organizationally defined and operationalized tends to be associated with local norms, values, languages, etc. This interaction of bureaucratic values and demands with local tasks and coding schemes produces a communication boundary that differentiates and insulates the unit from outside areas (Lawrence and Lorsch, 1967; Allen, 1977). As a result, different firms in the same industry may face similar problems yet may define their solution approaches and parameters very differently (Katz and Tushman, 1979). Locally oriented tasks, therefore, will require gatekeepers to provide the necessary effective linkage to external information and technology; direct contact by other subunit members will be ineffective.

If, however, a subunit's work is universally defined (scientific work, for example), then organizational factors will not be as much of an impedement to external communication. Individuals outside the unit (yet in similar professions or specialties) are more likely to share similar norms, values, methods, and language schemes, thereby, permitting more effective communication across organizational boundaries. Members working on universal tasks are simply more capable of understanding the nature of the problems and corresponding solution approaches employed by their relevant external colleagues. Scientists from one organization, for example, can easily communicate with scientists from any other organization about their overlapping sets of scientific interests and pursuits. (e.g., Hagstrom, 1965). For universally defined tasks, then, gatekeepers will not be required to link units to external information domains; instead, direct peer contact will be more advantageous.

The nature of a subunit's work, therefore, is a key contingent variable mediating the relationships between gatekeeper existence and subunit performance. In particular, it is proposed that gatekeepers will be positively associated with subunit performance only under the following conditions:

Hypothesis 1: Subunits performing locally defined tasks with gatekeepers will have significantly higher performance than subunits performing locally defined tasks without gatekeepers.

Hypothesis 2: Subunits performing universally defined tasks with gatekeepers will have significantly lower performance than subunits performing universal tasks without gatekeepers.

In analysis of variance terms, these hypotheses imply that there will be no main effect between the existence of gatekeepers and subunit performance; rather there will be a significant interaction between task characteristics and the existence of gatekeepers on subunit performance.

The need for information from relevant external areas exists independent of environmental conditions. While environmental turbulence may accentuate this need, it is hypothesized that environmental conditions are more likely to affect the number of gatekeepers emerging under local task conditions (Tushman, 1977), rather than the overall positive association between the existence of gatekeepers and subunit performance. For universal tasks, there will be an inverse relation between gatekeeper existence and subunit performance independent of environmental conditions.

Hypothesis 3: Environmental conditions will not affect the relationships between gatekeeper existence and subunit performance. Local tasks will have a positive relation while universal tasks will have a negative association, independent of environmental conditions.

Role of Gatekeepers

As previously suggested, gatekeepers are likely to faciliate higher performance for those subunits working on locally defined tasks. What, in fact, are the contributions of gatekeepers such that their existence in these subunits is positively associated with subunit performance? There are at least two alternatives. The more traditional explanation is that gatekeepers are a primary linking mechanism to external sources of information; information simply flows through these key individuals to the more local members of the network (Tushman, 1977; Baldridge and Burnham, 1975, Pettigrew, 1972; Whitley and Frost, 1973). From this perspective, relevant external information exists in subunits because of the boundary spanning activities of gatekeepers.

A different explanation is that gatekeepers take an active training, development, and socialization role within their work units. From this point of view, gatekeepers not only gather, translate, and encode external information, but they also facilitate the external communication of their colleagues (Blau, 1963; Sundquist, 1978). Gatekeepers may work to reduce the communication boundary between their subunit and external areas by directing, training and coaching the external communications of other subunit members. Under these conditions, both gatekeepers and other members of the subunit are able to effectively gather information from external areas.

If gatekeepers do permit other members to communicate effectively with external areas, then for subunits with local tasks and gatekeepers, there should be a positive assocation between a subunit's level of external communication and its performance. If gatekeepers do not play this more active role, then there should be an inverse relation between

a unit's level of external communication and its performance.

Given the substantial requirements for external communication in all but the most primitive of organizations; the inherent cognitive limits on information processing; and the fact that gatekeepers have their own tasks to perform, it is suggested that gatekeepers take an active role in both gathering information and facilitating the external communication of their unit colleagues. Accordingly, the following is hypothesized:

Hypothesis 4: The association between external communication and overall performance for locally oriented subunits will be significantly different for projects with and without gatekeepers. Projects with gatekeepers will have a positive association while projects without gatekeepers will have an inverse association.

Since gatekeepers perform the critical role of mediating external communication for subunits with locally oriented work, there will also be a positive association between the extra-organizational communication of gatekeepers and their unit's overall performance. To what extent, however, can supervisors substitute for gatekeepers and play this linking role to external areas?[3] Supervisors of locally oriented tasks face the same communication impedance problems as their subordinates when communicating externally. While supervisory communication within the organization may be postively associated with performance (e.g., Likert, 1967), their communication outside the organization will be inversely related to their unit's performance.

Hypothesis 5: For units with locally oriented work, supervisors who are not gatekeepers will have an inverse relationship between extra-organizational communication and project performance. Gatekeepers, however, will have a positive association between extra-organizational communication and project performance.

SETTINGS AND METHODS

To investigate the interrelationships among gatekeepers, communication, and subunit performance, a field study was carried out at the R&D facility of a large American corporation. Physically isolated from the rest of the organization, the R&D facility employed a total of 735 people. Given the objectives of our research, however, this study dealt only with the professional staff within the facility (N=345). The laboratory was organized into seven departments, each containing its own set of projects. At the time of our study, a total of 61 separate projects existed across the seven departments. These project units remained stable over the course of the study; and each R&D respondent was a member of only one project.

Technical Communication

To collect communication data, each professional was asked to specify those individuals with whom he or she had work related oral communications. This sociometric data was collected on a randomly chosen day each week for fifteen weeks. The sampling of days was constrained to allow for equal numbers of weekdays. Respondents were asked to report all oral work related contacts both within and outside the laboratory (including whom they talked to and how many times they interfaced with that person during the day). They were instructed not to report contacts that were strictly social, nor did they report written communications. During the fifteen weeks, the overall response rate was 93 peroent. Moreover, 68 percent of all the communications reported within the laboratory were mentioned by both parties (see Weiss

and Jacobson, 1969, for comparative data). Extra-laboratory communications, however, could not be corroborated with discussion partners.

Project communication is a measure of the average absolute amount of technical communication per person per project over the fifteen weeks. As discussed in Katz and Tushman (1979), six mutually exclusive communication measures were operationalized for each project as follows: (1) communication within the Project; (2) communication to other areas within the project's Department; (3) communication to other areas in the Laboratory (but outside of the Department); (4) communication to areas in the larger Organization; (5) communication to external Professionals outside the parent organization, including consulting firms, universities, and professional societies; and (6) communication to external Operational areas, including, suppliers, vendors, and customers. Extra-organizational (i.e., external) communication is the sum of the reported communication to professional and operational areas. Individual responses were pooled to obtain project communication with these various areas.

Although the literature has used a number of slightly different criteria to empirically define gatekeepers (Allen, 1970; Whitley and Frost, 1973), conceptually, they are always defined as those internal stars (i.e., high internal communicators) who also maintain a high degree of extra-organizational communication. This study operationalized gatekeepers as those individuals who were in the top fifth of their intra-department communication distribution and who were also in the top fifth of the extra-organizational communication distribution. Gatekeepers were identified in 20 projects; 40 projects had no gatekeepers.

Project Taks Characteristics

In R&D settings, tasks can differ along several dimensions, including time span of feedback, sepcific vs. general problem-solving orientation, and generation of new knowledge vs. utilization of existing knowledge and experience (Rosenbloom and Wolek, 1970). With these dimensions, the following tasks categories were developed with the laboratory's management to form a universal (research) to local (technical service) task dimension.

a. Basic Research: Work of a general nature intended to apply to a broad range of applications or to the development of new knowledge about an area.

b. Applied Research: Work involving basic knowledge for the solution of a particular problem. The creation and evaluation of new concepts or components but not development for operational use.

c. Development: The combination of existing feasible concepts, perhaps with new knowledge, to provide a distinctly new product or process. The application of known facts and theory to solve a particular problem through exploratory study, design, and testing of new components or systems.

d. Technical Service: Cost/performance improvement to existing products, processes or systems. Recombination, modification and testing of systems using existing knowledge. Opening new markets for existing products.

Using these definitions, respondents were asked to select the category which best characterized the objectives of their project and to indicate, on a three-point scale, how completely the project's objectives were represented by the selected category. The twelve possible answers were scored along a single scale ranging from completely basic research to completely technical service.

As in Pelz and Andrews (1966), respondents were also asked to indicate what percentage of their project's work fell into each of the

four categories. A weighted average of the percentages was calculated for each respondent. The scored responses to these two questions were averaged (Spearman-Brown reliability = .91). Project scores were calculated by pooling individual scores.

Project Task Environment

Of the many environmental dimensions studied, Duncan (1972) and Neghandi and Reimann (1973) suggest that the stable-changing dimension is a particularly important contributor to perceived uncertainty. Based on this research, only the stable-changing dimension of the environment was investigated in this study. Each respondent was asked to answer the following question:

> We are interested in how rapidly you see the demands of your job changing. To what extent are techniques or skills or information needed for your project changing? (A five-point Likert-scale was used with 1 as the lower anchor).

Project scores were calculated by pooling individual scores.

Unit of Analysis

Since projects are the unit of analysis, the homogeneity of a project member's perception of each variable was tested to check for the appropriateness of pooling (see Tushman, 1977 for details). As pooling was appropriate for each variable, individual responses were combined to get project scores. The distribution of project task scores were easily clustered into three distinct categories: (1) Research (a combination of basic and applied research categories); (2) Development, and; (3) Technical Service. For the most part, research projects carried out universally oriented scientific work (for instance, developing new knowledge in glass physics), while development and technical service

work was locally oriented in that they worked on organizationally defined problems and products. Task environment was split at the median when used as an ordinal variable, indicating either a relatively stable or changing work environment.

Project Performance

As performance measures are particularly difficult to develop for R&D settings (Whitley and Frost, 1971) a subjective measure similar to that used by Lawrence and Lorsch (1967) was employed. Each Department manager (n=7) and Laboratory director (n=2) was interviewed separately. They were asked to evaluate the overall technical performance of all projects with which they were technically familiar.

Each manager interviewed was asked to make their informed judgments based on their knowledge of and experience with the various projects. If they could not make an informed judgment for a particular project, they were asked not to rate the project. Criteria the managers considered (but were not limited to) included: schedule, budget, and cost performance; innovativeness; adaptability; and the ability to cooperate with other areas of the organization. Each project was independently rated by an average of 4.7 managers on a seven-point scale (from very low to very high). As the performance ratings of the nine judges were sufficiently intercorrelated (Spearman-Brown reliability = .81), individual ratings were averaged to yield overall project performance scores.

Demographic Data

During the course of the study, demographic data was also collected from the laboratory's professionals, including their age, educational degrees, years in the laboratory, and years in their current project.

RESULTS

Gatekeepers and Project Performance

According to the hypothesized relationships, there should be no overall main effect between gatekeepers and subunit (i.e., project) performance; rather the particular associations should be contingent on the nature of the projects' task characteristics. Hypothesis 1 reasoned that as a result of the mismatch in coding schemes between locally oriented tasks (i.e., development and technical service projects) and external areas, these project subunits would have a positive association between the existence of gatekeepers and project performance. Hypothesis 2, on the other hand, argued that since universal (i.e., research) tasks would not face this mismatch in coding schemes, these subunits would be more effectively linked to external areas through direct contact by all project members. As a result, research projects may have an inverse relation between the existence of gatekeepers and project performance.

As expected, the means reported via Table 1 confirm that, in general, the performance scores of projects with gatekeepers are not significantly different from the performance scores of projects without gatekeepers.

Insert Table 1 About Here

To investigate the specific hypotheses, two-way ANOVA was first employed to test for the interaction effect between task conditions and gatekeeper existence on project performance (see Table 2). As hypothesized, there are no main effects on project performance for either the existence of gatekeepers or for task characteristics. There is, however, a rather strong structural interaction effect.

Insert Table 2 About Here

More specifically, the breakdown of performance means, as shown in Table 3, strongly supports the second hypothesis. Research projects with gatekeepers are significantly lower performing than those research projects without gatekeepers. In fact, the correlation between the existence of gatekeepers and project performance is significantly negative ($r=-.47; p<.05$). As a result, research projects are probably linked to external areas more effectively through direct member contact.

Insert Table 3 About Here

There is also partial support for hypothesis 1 in that development projects with gatekeepers are significantly more effective than those development projects without gatekeepers. In sharp contrast with research projects, the correlation between the existence of gatekeepers

and the performance of development projects is strongly positive ($r=.51; p<.01$). Unlike research projects, development projects are effectively linked to external areas through gatekeepers. Technical service projects on other hand, exhibit no significant differences between those units with and without gatekeepers. As a result, the mechanisms used by technical service projects remain unclear. The performance scores displayed by Figure 1 highlight the differential impact of gatekeepers on research vs. development projects. Technical service projects are not plotted as their performance ratings were unaffected by the presence or absence of gatekeepers.

Insert Figure 1 About Here

Because environmental conditions have been shown to affect the emergence of boundary spanning individuals, it is also important to determine the stability of the foregoing relationships across different kinds of task environments. Table 4 provides clear support for such stability.

Insert Table 4 About Here

Development projects exhibit a positive correlation between the existence of gatekeepers and project performance independent of

environmental conditions. Whether the environment is seen as stable or turbulent, locally oriented projects are most effectively linked to external areas through gatekeepers. Research projects, on the other hand, maintained their inverse association between the existence of gatekeepers and project performance across environmental conditions. As predicted, universally oriented projects are probably linked to external areas more effectively through direct contact. As before, there is no evidence of any significant gatekeeper effects for the technical service projects.

Role of Gatekeepers

As argued by hypothesis 4, it is possible that gatekeepers on locally oriented tasks do considerably more than simply channel information from external areas into the subunit. Gatekeepers may act to reduce the communication impedance between local and external areas by training, directing, and socializing their fellow colleagues. If gatekeepers serve this dual role then both gatekeepers and their peers will be able to communicate effectively with external areas. Contrastingly, those locally oriented projects without gatekeepers will have no clear effective link to external areas.

Results reported in Table 5 support these ideas. For development and technical service projects without gatekeepers there is a consistent inverse association between members' extra-organizational communication and project performance. For those locally oriented projects with gatekeepers, however, a significantly different pattern emerges. For these projects, extra-organizational communication is positively associated with project performance. These positive correlations

remain strong even after the direct communication effects of gatekeepers are removed! As a result, it would appear that gatekeepers can have a strong impact on project members' ability to communicate directly with external areas.

Insert Table 5 About Here

Consistent with earlier results (see Table 3), members of research projects do not face a communication impedance when communicating externally. Their extra-organizational communication is positively associated with project performance independent of the existence of gatekeepers. If anything, results in Table 5 suggest that gatekeepers might hinder the external communication of research project members. Gatekeepers, then, do not play an important information transfer role in the more universally oriented reserach projects; while they seem to play a vital role in the more locally defined development and technical service projects.

To what extent can supervisors of development and technical service projects substitute for gatekeepers in linking their units to external areas? Hypothesis 5 reasoned that while supervisors might have an advantage for intra-organizational communication, they face the same communication impedance as their subordinates for extra-organizational communication. Due to the communication mismatch between locally defined projects and external areas, it was hypothesized that for supervisors who were not gatekeepers, the greater their external

communication, the lower the performance of their project. However, gatekeepers (whether they be supervisors or not) should have a positive association between their extra-organizational communication and project performance. As a result, it was hypothesized that supervisors could not substitute for gatekeepers.

The correlations reported in Table 6 tend to support these ideas. For development and technical service projects, the greater the extra-organizational communication of supervisors who were not gatekeepers, the lower their project's performance. Generally speaking, supervisors are not necessarily an effective linking mechanism to external domains. Contrastingly, the association between external communication and project performance was very different for those supervisors who are also gatekeepers. The greater the external communication of these individuals, the greater their project's performance. The differences in the correlations between those supervisors who were gatekeepers and those who were not are statistically significant, indicating that supervisory status alone can not deal with the requirements for effective linkage to external areas. (As most gatekeepers are also supervisors, there are simply not enough cases to investigate the association between the external communication of gatekeepers who are not supervisors and project performance).

Insert Table 6 About Here

Alternative Explanation

Given the nature of the preceding correlations, alternative explanations must be examined. It is conceivable, for example, that restricted variances in either the performance or communication measures could help explain the changing pattern of correlations across the different categories. Accordingly, for all of the pairwise correlational comparisons, means and standard deviations were checked to ensure that none were significantly different.

Furthermore, it is important to make sure that the composition of projects with and without gatekeepers do not differ in some other meaningful way. It has been suggested by a number of studies, including Pelz and Andrews (1966) and Katz (1979), that project behaviors such as communication and innovation might be influenced by certain demographic characteristics including age, education, and project tenure. To rule out such rival possibilities, Table 7 compares the various project groupings along several important demographic variables. As there are no statistically significant differences in Table 7, rival hypotheses based on demographic differences are less plausible.

Insert Table 7 About Here

DISCUSSION

The acquisition of information and new technology from external areas is vital for organizations. It was hypothesized that there are at least two distinct methods by which subunits can acquire external

information: direct contact by members of the subunit and contact mediated by gatekeepers. This research has investigated two basic questions with respect to these methods: 1) under what conditions will gatekeepers be a more effective linking mechanism than direct contact; and 2) what role do gatekeepers play in mediating the flow of external information.

Our evidence suggests that the external linkage mechanism is contingent on the strength of the communication impedance separating a focal unit from its external information areas. Generally speaking, as tasks become more locally defined, it is likely that language and cognitive differences between the unit and its extra-organizational domains will increase, thereby, intensifying communication impedance and more tendentious information flows. Communication across organizational boundaries, as a result, are often hampered and inefficient.

It is not that relevant and important information does not exist with outside sources, rather it becomes more difficult to exchange information with adequate accuracy, assurance, and comprehensibility as problems and tasks become more locally constrained. As a result, the gatekeeping function is more likely to be an effective process for channeling external technology and information into organizational subunits working on locally oriented tasks. Clear support for this argument lies in the finding that development projects with gatekeepers had significantly higher performance ratings than those development projects without gatekeepers. On the other hand, research projects whose problems and tasks are more universally oriented were higher performing without the gatekeeping function. The more effective research projects seemed to rely on direct member contact with external

sources of information rather than on communication mediated by gatekeepers. Moreover, the effectiveness of these different linking mechanisms for research and development tasks remained significant across relatively different kinds of environmental conditions.

Contrary to expectations, the performance of technical service projects was not related to the presence of gatekeepers. If members of technical service projects without gatekeepers communicate less proficiently with extra-organizational domains than technical service project members with gatekeepers (as shown in Tables 5 and 6); and yet, their corresponding performance scores are not significantly different, then how are technical service projects without gatekeepers effectively linked to sources of external information? Furthermore, why should such a difference emerge between the findings of development and technical service projects if they are both working on tasks and problems that are more locally than universally defined?

A possible explanation may be found from differences in the nature of the work performed by development and technical service areas. Development projects involve in dynamic technology, new knowledge, and/or new products. Consequently, uncertainty is relatively high in these projects and the locus of relevant task expertise will be with project members. Technical service projects, on the other hand, work with mature technologies, existing knowledge, and existing products. Task uncertainty is relatively low and the locus of task expertise may reside outside the project, most likely in more senior levels of the hierarchy (Rosenbloom and Wolek, 1970).

If the locus of expertise and decision making is relatively high for technical service projects, it may be that they can be linked to

external areas not only by gatekeepers within the project, but by more senior levels of the hierarchy. More generally, this argument suggests that both the locus of task expertise and the nature of a subunit's task are key contingent variables for understanding the mechanisms by which units are externally linked. For locally oriented subunits where task expertise is located within the subunit, gatekeepers can be an effective linkage to external areas. Where tasks are locally oriented but the expertise lies higher in the hierarchy, the unit might also rely on the formal hierarchy as an effective external linking mechanism. This explanation, moreover, is consistent with the research findings of Walsh and Baker (1972) and Frost and Whitley (1971) regarding technical service projects.

While our findings are not conclusive, they do indicate that linkages to external areas are contingent on the nature of the unit's work and the locus of expertise within the organization. For universal tasks, direct external communication may be most effective since communication impedance is low. For local tasks, direct contact may be ineffecient since the communication impedance separating the unit from external areas is substantial. External information, therefore, must flow into the unit indirectly, either through gatekeepers if task uncertainty is relatively high or through senior levels of the hierarchy if task uncertainty is relatively low (Allen et al., 1979).

What role do gatekeepers perform in linking local projects to external areas? The data indicate that gatekeepers not only bring in information from external areas, but perhaps more importantly, they facilitate the extra-organizational communication of their more locally oriented colleagues. In locally oriented subunits, gatekeepers may

actually increase the information processing capabilities of their units by reducing the communication impedance separating their unit from external areas. Thus, locally oriented subunits with gatekeepers may be able to take better advantage of external technologies and information since the number of members capable of communicating across the unit's boundary increases with correspondingly less dependence on gatekeepers for gathering and disseminating external information. Development tasks without gatekeepers have no obvious mechanism for effective linkage to external areas. In universally oriented tasks, on the other hand, gatekeepers are not a critical source of external information, nor do they serve any communication facilitating function. Research project members can not rely on others for their external information; in a sense they must be their own gatekeepers.

Project supervisors can not substitute for gatekeepers in linking locally oriented units to external areas. The extra-organizational communication of supervisors who were not gatekeepers was inversely associated with project performance. While supervisors may have well developed and useful internal linkages, they face the same extra-organizational communication impedance as their subordinates. Unlike their peers, the external communication of supervisory gatekeepers was positively associated with project performance. Gatekeepers, therefore, play a key role in communication networks; a role that is different yet complementary to the supervisory role. These data suggest distinguishing between two types of project supervisors: those supervisors who have a local orientation and those who are more cosmopolitan (that is, supervisors who are also gatekeepers). Locally oriented supervisors may be most influential in administrative or

budgetary kinds of activities and decisions, while gatekeeping supervisors may be more useful on those tasks requiring considerable technical activity and decision making.

Briefy summarizing, direct peer contact and contact mediated by gatekeepers are alternate mechanisms by which subunits can be linked to external sources of information. And both mechanisms can be appropriate under certain conditions. As previously discussed, the choice of linkage to external areas should be contingent on the nature of the unit's work and the locus of task expertise within the system.

FUTURE RESEARCH

On the assumption that gatekeeping is an important organizational function, we need to learn considerably more about these kinds of roles and their occupants. How do gatekeepers evolve within an organizational area and how stable are these roles? To what extent can individuals in higher hierarchical positions substitute for gatekeepers, especially on more routine tasks? And finally, how should gatekeepers be managed, rewarded, and promoted in various functional areas, especially gatekeepers who may not have or desire formal supervisory positions as in dual-ladder situations. In fact, it may prove very fruitful to study career and reward systems such as the dual-ladder by examining the impact of such systems on behavioral processes and roles like information and technology transfer, innovation, and gatekeeping.

Future research should also examine the influence of organizational structures on the functionality and existence of gatekeepers. Formally structured units, for example, might have a greater need for gatekeepers

(Tushman, 1977). If we are to trully understand alternative organizational designs, we must begin to examine empirically the effects of functional, project, and matrix type designs on both internal and external communication flows as well as the role that gatekeepers can play in these various information processing structures (Katz and Tushman, 1979).

Most of the gatekeeper research has also been limited to lower levels within the formal hierarchy. How should more senior level managers within the organization interface with gatekeepers and external sources of information and technology. Research by Keegan (1974), Edstrom and Galbraith (1977), and Sundquist (1978), suggest that gatekeepers might be less important for the more general kinds of external information needed by senior levels, yet may be very important for the highly specialized and/or technical information often required by lower levels. Moreover, if gatekeepers are important in linking their subunits to external areas, they may be relatively powerful individuals (Pettigrew, 1972; Spekman, 1979; March and Simon, 1958). Future research must begin to investigate the role of gatekeepers beyond that of information transfer and training. To what extent are they influential and involved in administrative, strategic, and technical decision making?

In conclusion, gatekeepers are an important organizational phenomenon. They are, however, a functional network characteristic only under certain conditions. Depending on a subunit's task, the locus of expertise within the system, and the organizational structure, either gatekeepers, direct member communication, or the formal hierarchy can provide effective contact with sources of external information and

technology. If we are to design complex organizations with their pluralistic environments and information needs, we must learn considerably more about concepts like differentiation, local language development, and communication impedance; and more importantly, how such factors influence information processing and decision making activities.

FOOTNOTES

1. This research makes a basic distinction between gatekeepers and boundary individuals who simply have substantial boundary spanning activities (BSA). To trully satisfy a boundary spanning function, an individual should be strongly connected both internally and externally. The assumption in many previous boundary spanning studies, including Keller et al., 1976; Leifer and Huber, 1977; Bacharach and Aiken, 1977, is that those individuals reporting high BSA are also well-integrated internally, transferring and disseminating their information to others in the organization. Such a blanket assumption, however, is often unjustified. Evidence suggests that unlike gatekeepers, individuals with high BSA are frequently isolated and are often low performing individuals (Allen, 1970; Roberts and O'Reilly, 1979). Or, as von Hippel (1976) has found, those individuals who serve representational roles (and are, therefore, high on BSA) are often not an effective or highly utilized source of informaton for other relevent organizational members.

2. This research focuses primarily on the flow of communication across organizational boundaries and does not investigate potential relations among gatekeeper status, intra-organizational power, and decision making. See discussion section.

3. Extant research indicates that usually between 50 and 80 percent of the gatekeepers are also first-level superivsors. As a result,

these roles are not independent but somewhat complementary (Allen, 1977; Tushman and Scanlan, 1979). This reseach distinguishes between gatekeepers, supervisors who are also gatekeepers, and supervisors who are not gatekeepers.

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TABLE 1

Project Performance As A Function of Gatekeeper Presence

	Mean Project Performance	Standard Deviation
Projects With Gatekeepers (N=20)	4.70	0.702
Projects Without Gatekeepers (N=40)	4.53	0.729
Mean Difference =	0.17+	

+Not significantly different at the $p < .10$ level.

TABLE 2

Analysis of Variance on Project Performance By
Type of Project and Gatekeeper Presence

SOURCE OF VARIATION	DF	MEAN SQUARE	F-VALUE
Gatekeeper Presence	1	0.425	0.93
Type of Project (R, D, or TS)	2	0.588	1.29
2-Way Interaction	2	2.152	4.73***
Error	54	0.455	

< .10; **p < .05; ***p < .01

TABLE 3

Project Performance As A Function of Project Type and Gatekeeper Presence

PROJECT TYPE	MEAN PERFORMANCE FOR PROJECTS WITH GATEKEEPERS	MEAN PERFORMANCE FOR PROJECTS WITHOUT GATEKEEPERS	T-Value FOR MEAN DIFFERENCES
Research	4.22 (N=5)	4.92 (N=9)	-1.88**
Development	4.91 (N=8)	4.15 (N=15)	3.10***
Technical Service	4.80 (N=7)	4.67 (N=16)	0.38

*p < .10; **p < .05; ***p < .01

TABLE 4

Correlations Between Project Performance and Gatekeeper Presence By Project Type and Project Environment

PROJECT TYPE	Measures	Project Environment: Stable	Project Environment: Changing	Total Sample
RESEARCH	a) Mean Project Performance	4.85	4.54	4.67
	b) Correlations Between Project Performance and Gatekeeper Presence	-.41 (N=6)	-.49* (N=8)	-.47** (N=14)
DEVELOPMENT	a) Mean Project Performance	4.41	4.49	4.43
	b) Correlations Between Project Performance and Gatekeeper Presence	.53** (N=11)	.62** (N=11)	.51*** (N=23)
TECHNICAL SERVICE	a) Mean Project Performance	4.80	4.75	4.78
	b) Correlations Between Project Performance and Gatekeeper Presence	I[a] (N=11)	.07 (N=10)	.02 (N=23)

*p<.10; **p<.05; ***p<.01

[a]Insufficient variance as none of these projects had a gatekeeper.

Note: None of the correlations or mean project performance scores significantly differed by project environment.

TABLE 5

Correlations Between Project Performance and External Communications
By Project Type and Gatekeeper Presence

PROJECT TYPE	MEASURES OF EXTERNAL COMMUNICATIONS	CORRELATIONS WITH PERFORMANCE FOR PROJECT: WITH GATEKEEPERS	CORRELATIONS WITH PERFORMANCE FOR PROJECT: WITHOUT GATEKEEPERS
RESEARCH	a) All project members	.53	.46*
	b) All project members excluding the project's gatekeeper (in the first column) or the project's supervisor (in the second column)[a]	.37 (N=5)	.70** (N=9)
DEVELOPMENT	a) All project members	.31	-.45**
	b) All project members excluding the project's gatekeeper (in the first column) or the project's supervisor (in the second column)	.55* (N=8)	-.21 (N=15)
TECHNICAL SERVICE	a) All project members	.31	-.19
	b) All project members excluding the project's gatekeeper (in the first column) or the project's supervisor (in the second column)	.64* (N=7)	-.03 (N=16)

*$p < .10$; **$p < .05$; ***$p < .01$

[a]80%, 75%, and 71% of the gatekeepers in the research, development, and technical service project groups, respectively, were also project supervisors.

Note 1: Underlined pairwise correlations are significantly different at the $p < .10$-level.

TABLE 6

Correlations Between Project Performance and the External Communications of Project Supervisors By Project Type and Gatekeeper Presence

PROJECT TYPE	Correlations Between Project Performance and External Communications For: Project Supervisors who are also Gatekeepers	Project Supervisors who are not Gatekeepers
DEVELOPMENT	.37 (N=6)	-.51** (N=15)
TECHNICAL SERVICE	.77* (N=5)	-.34* (N=16)

< .10; **p < .05; ***p < .01

e: The underlined correlations are significantly different at the p < .10 and p < .05 levels, respectively.

TABLE 7

Mean Comparisons Between Gatekeeper Categories within Project Types

PROJECTS TYPES		-- MEAN PROJECT SCORES FOR -- Highest Degree [a]	Laboratory Tenure (in yrs)	Project Tenure (in yrs)	Age (in yrs)
RESEARCH	a) with Gatekeepers	2.7	6.4	3.8	40.4
	b) without Gatekeepers	2.6	7.3	2.5	36.7
DEVELOPMENT	a) with Gatekeepers	2.2	7.6	2.9	38.4
	b) without Gatekeepers	2.2	6.0	2.8	38.3
TECHNICAL SERVICE	a) with Gatekeepers	2.1	5.8	3.5	37.2
	b) without Gatekeepers	2.1	7.5	4.9	40.0

[a](1 < B.S.; 2 = B.S.; 3 = M.S.; and 4 = Ph.D.)

Note: None of the pair-wise mean comparisons are significantly different at the $p < .10$ level of significance. See Table 3 for N's.

FIGURE 1

Mean Performance of Development and
Research Projects By Gatekeeper Presence