

# Does E-Mail Make White Collar Workers More Productive?

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## Abstract

We report on a four-year investigation of how information flows affect white-collar productivity. For this research, we developed software to track all e-mail activity within a midsize executive recruiting firm. We also negotiated access to three separate data sets including: (1) project level accounting measures of revenues, (2) surveys of individual perceptions of information technology and information sharing, and (3) direct observation of e-mail activity over a period of six months. We found statistically significant relationships between the structure of a recruiter's internal e-mail network and success at both landing and executing contracts. In addition to traditional social network analysis techniques, we also considered dynamic measures of e-mail behaviors and flows. Sending smaller e-mails was associated with better performance in both landing and executing contracts, while receiving prompter responses from colleagues was associated with success in executing, but not landing contracts. These results provide some of the first statistical evidence that information flows and use of information technology affect individual productivity at the desktop level. They also demonstrate how measures of information behaviors and flows can complement traditional techniques of social network analysis to provide richer models of the effects of information management practices on individual and organizational performance.

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E-mail has become a ubiquitous feature of office life. Recent surveys report that all but 2 percent of employed Americans have e-mail access at work, while the time business users spend managing e-mail averages nearly an hour a day (Grey 2001; Fallows 2002). However, little is known about whether and under what conditions e-mail makes white-collar workers more productive. In this paper, we ask whether statistically significant relationships can be found between e-mail communications and individual output within a mid-sized executive recruiting firm.

## Literature and Hypotheses

Our investigation of relationships between e-mail and productivity considers two types of variables: structures and flows. Social network analysis has been used to offer support for the economic importance of relationships in contexts including job search (Granovetter 1973; Lin, Ensel et al. 1981), commodities trading (Baker 1984) and the financing of small business loans (Uzzi 1999). Rangan (2000) speculates social networks have the greatest economic value in contexts involving search and deliberation, both of which play key roles in executive recruiting. Khurana (2002) provides a qualitative network study of executive recruiters and Cummings (2004) relates social networks to performance in the context of knowledge sharing among structurally diverse work groups, but as far as the authors are aware this is the first quantitative study using social network analysis and direct observation at the individual message level to analyze accounting measures of productivity at the desktop level.

Executive recruiters derive economic value from brokering information between parties – a client looking to fill a job and potential candidates for the position. Individuals who effectively bridge informational gaps between communities of knowledge, termed structural holes, are hypothesized to generate economic benefits in the form of access, referrals and timing (Burt 1992). While bridging structural holes might facilitate both landing and fulfilling contracts, we predict a stronger association with the former. Fulfilling contracts is a quasi-routine process that typically involves screening upwards of 100 potential candidates, while the care and feeding of client relationships involved in landing contracts is typically less structured. Since the value of bridging structural holes comes from information that helps resolve ambiguity, it is often greater in less structured environments. We propose:

**Hypothesis 1a.** The effective size of structural holes in a recruiter's internal e-mail network will be positively related to bookings revenue.

While a single recruiter often represents the firm in landing contracts, contracts are usually executed by teams. In the firm we studied: 35.4 % of contracts were fulfilled by a single recruiter, 56.3 % by two recruiters, 8 % by three recruiters and 0.3 % by four recruiters. Recruiters positioned on the shortest paths between others in the firm's communication's network may have the greatest opportunities for involvement in search teams. We propose:

**Hypothesis 1b.** The betweenness centrality of a recruiter's internal e-mail network will be positively related to billings revenue.

The use of e-mail data offers the opportunity to measure the influence of information behaviors and flows. Consideration of behaviors and dynamics has the potential to greatly enrich traditional social network analysis (Carley 1991; 1995; 2003). For example, theories of media richness suggest that media that contain more environmental cues will be favored in more ambiguous situations (Daft and Lengel 1984; Daft and Weick 1984). In contrast to face-to-face, e-mail is a relatively lean medium. This suggests recruiters who send shorter messages, pursuing more complicated interactions through other media, may be more efficient:

**Hypothesis 2:** Sending smaller e-mail messages will be positively related to bookings and billings revenue.

Contingency theory suggests innovations that resolve communication bottlenecks or enable individuals to process greater quantities of information in the same amount of time can potentially increase efficiency (Thompson 1967; Galbraith 1973). Used effectively, the asynchronous nature of e-mail might enable recruiters to increase billing revenue by juggling more projects simultaneously. We express this as:

**Hypothesis 3:** Shorter response times from colleagues will be positively related to billings revenue.

## Methodology

This paper uses econometric methods to investigate the influence of informational factors on individual performance. Hypotheses were tested using ordinary least squares and the following basic regression model:

$$(0.1) \quad Q_i = a + b' H_i + g' X_i + dY_i + e_i$$

The determinants of productivity ( $Q_i$ ) in eq. (0.1) include dummy variables ( $H_i$ ) for the industry sectors (eg. finance, health care) and percentages for the job level of searches (eg. CEO, VP, other), human capital ( $X_i$ ) reflected in recruiter's years of experience, information behavioral treatments ( $Y_i$ ), constant ( $\alpha$ ) and error terms. Years of education and gender were originally included as controls in  $X_i$ , but were dropped after they were found to have little effect. Capital is included in the constant term since it is the same for all recruiters. Dummy variables that were found to be statistically significant in any of the regressions were kept and used in all regressions while the others were discarded to preserve degrees of freedom.

## Results

**Table 1 - Relationships between network structure and performance**

Variables	Bookings Revenue				Billings Revenue			
	B	S.E.	Adj. R <sup>2</sup>	Sig. F Change	B	S.E.	Adj. R <sup>2</sup>	Sig. F Change
Base Model			0.40				0.19	
Size of structural holes	13770***	4647	0.52	0.006	7890*	4656	0.24	0.100
Betweenness Centrality	1297*	773	0.47	0.040	1696**	697	0.30	0.021

N = 39 recruiters, \*\*\* P < 0.01, \*\* P < 0.05, \* P < 0.10.

Base Model: Yrs. of Exper., Partner (dummy), CEO Searches (%), Industry Sector (dummies), Solo Searches (%).

As predicted by theory and hypothesis 1, structural holes were more strongly related to bookings revenue, while betweenness centrality was more strongly related to billings revenue (Table 1). Statistically significant changes in the F-Statistic (0.006 for structural holes and bookings revenue; 0.021 for betweenness centrality and bookings) support a relationship between the structure of a recruiter's internal e-mail network and performance. It is important to note that we make no claims of causality. Informational benefits from bridging structural holes might enable recruiters to more effectively land contracts. Alternatively, recruiters who land more contracts might be more highly sought after by others, particularly consultants who are more dependent on partners for billing revenue. Both explanations are consistent with existing theory. In fact, we found the effective size of structural holes in recruiters' internal e-mail networks to be positively correlated with self-reported contributions to both mentoring (0.391,  $p < 0.15$ ) and information sharing (0.537,  $p < 0.05$ ), suggesting that under certain conditions structural holes may arise result from cooperative as well as competitively motivated behavior.

**Table 2-Relationships between information flows and performance (in addition to structure)**

Variables	Booking Revenue				Billings Revenue			
	B	S.E.	Adj. R <sup>2</sup>	Sig. F Change	B	S.E.	Adj. R <sup>2</sup>	Sig. F Change
Base Model			0.40				0.19	
Best Structural Predictor	12604***	4454	0.52	0.006	1544**	639	0.30	0.021
Ave. Email Size	-10.7**	4.9	0.56	0.042	-9.3*	4.7	0.34	0.095
Ave. Response Time	-198947	168968	0.56	0.248	-368924	157789	0.42	0.026

N = 39 recruiters, \*\*\* P < 0.01, \*\* P < 0.05, \* P < 0.10. Base model remains the same as in Table 1.

Best structural predictor is effective size of structural holes for booking and betweenness centrality for billing revenue.

We also found full support for the relationships between information flows and performance predicted in hypotheses 2 and 3 (Table 2). Sending shorter e-mail was positively related to billings and bookings revenue, while more timely responses from colleagues were positively related to billings revenue. We emphasize that these benefits were found on top of the benefits flowing from network structure, as indicated by the significant changes in the F-statistic as behavioral and flow variables were added to models with statistically significant social network variables. The positive relationship between shorter e-mails and performance has normative value. Further analysis revealed a positive correlation between a recruiter's e-mail response time and colleagues' response times to that individual

(0.398,  $p < 0.01$ ), suggesting that one way to encourage faster responses is to respond more promptly to others. Additionally, the response time of colleagues correlated positively with perceptions of information overload (0.390,  $p < 0.02$ ) and negatively with perceptions that technology enables the handling of more simultaneous projects (-0.326,  $p < 0.05$ ). This suggests the potential for a vicious cycle associating overload with slower responses, potentially leading to slower responses from others and more overload. It also illustrates that it is not e-mail *per se* that is likely to influence productivity, but rather how it is used. Finally, we note that the measure of response time we found to be statistically significant set three business days as a maximum, beyond which a reply was coded as a new thread as opposed to a response. Other specifications we tried, such as responding within less than one business day, did not appear to matter, while maintaining a continuity of responses over the work week did.

Taken together, these results contribute to a longstanding debate among economists by providing some of the first statistically significant evidence relating use of information technology at the individual desktop level to productivity (Brynjolfsson and Hitt 2000; Jorgenson 2001). While obtained within the context of executive recruiting, many of the skills recruiters use, such as interviewing, negotiating, research and project management, are common to other forms of white-collar work. Occupations to which such results could potentially be generalized include law, consulting and accounting in the private sector, and political action groups and university development in the public sector. Finally, these results suggest the promise of dynamic network analyses that consider information flows and behaviors as well as structure as a general research strategy leading towards more comprehensive modeling of relationships between organizational communications patterns and performance.

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