

Organizing Electronic-Based Channels of Internal Communications

Abstract: Recent developments in communications technologies have opened up new opportunities for organizations to manage their internal communications more effectively. New systems are likely to encourage decentralized decision-making through its effect on employee ability to share information more freely. However, not all organizations are likely to embrace electronic-based channels of communications on account of the prohibitive costs involved in acquiring new technologies and providing employee training. The study aims to investigate the incidence and impact of electronic mail (e-mail) using data from the British 1998 Workplace Employee Relations Survey. The results show a significant relationship between email and various establishment and employee characteristics. Educated workers and large and medium size workplaces are more likely to use e-mail. Workplaces with e-mail facilities are also more likely to encourage employee control over work and provide extended training opportunities.

Keywords and Phrases: Internal communications, e-mail, organizational design, employee participation, training

A strong internal communications practice is increasingly viewed as core organizational capability that adds value from both a commercial and employee perspective. The practice may be wide-ranging, from keeping employees informed on a regular basis about business strategies to informing them of recent changes in personnel. The goal is to create understanding of the company's objectives and values in a way that helps individuals understand their own contribution to achieving the company's performance targets. Internal communications may thus engender a stronger sense of ownership and commitment to the company's culture, resulting in improved matching between individual preferences and job requirements.

Yet, as workforces become more mobile and decentralized, effective internal communications becomes increasingly difficult [6, 8]. In the past, voids were either filled with overlaps in functions or through a horizontal company structure with reduced hierarchies. However, with the recent developments in technologies and increased global competition, internal communications strategy has become more

complex and requires a systematic approach for obtaining desired results [9, 12]. For instance, although the solution is widely seen in the adoption of new technologies such as electronic mail (e-mail) to improve the efficacy of communication channels, little is known about the nature of the relationship between existing organizational practices and how they influence the outcome of new communications technologies [5].

Previously, when internal communications as a term (at least) was novel, its primary concern was with the motivation of organizational employees [3]. It was used to ensure that management's message was reaching shop-floor workers and, in doing so, was motivating them to work harder in support of organizational goals [10, 11]. As a result, early communication channels were concerned with the effectiveness of *messages* being sent within organizations, and primarily with those messages that went up and down the line of management [14]. With the later development of the e-mail becoming a regular channel for information flows, it has become possible to look at communication *systems* as a whole within organizations.

This has important implications for the direction of organizational change as new channels of communication are introduced. For example, Brigham and Martin [5] examine the role of e-mail in shaping the power structure within organization. A related question is whether e-mail facilitates the delegation of authority to lower levels of organizational structures – a prime concern of flexible organizations. The literature on employee participation and information sharing arrangements explores the benefits that management can derive from having shop-floor employees with the power to make operational decisions. However, this work does not explicitly

investigate the impact of electronic-based channels of internal communications on such processes of organizational restructuring.

E-mail communications is also often an innovation for a workplace and the pressure on both the managers and employees is intensified as the use of e-mail strategy is highly visible and relatively expensive at the start. It will therefore be useful to know the likely factors that impinge upon the use of e-mail from both the workplace and employee perspective. Employee choices can be critical as the success of e-mail strategy is particularly dependent upon employee willingness to learn and adopt new technologies. To identify those employees who are likely to use e-mail as part of organization's internal communications system will be important for managers so as to introduce appropriate employee training and benefit regimes. Similarly, organizational factors that affect the design and implementation of the electronic-form of internal communications will also need to be studied to obtain a better match between new technologies and existing organizational capabilities.

The present study examines these questions by conducting an empirical study of the determinants of electronic mail-based systems of internal communications. This is made possible by the recent availability of the 1998 British Workplace Employee Relations Survey (WERS98), as it provides a comprehensive employer-employee linked dataset on the managers' and employees' own assessment of the use and effectiveness of electronic mail. The specific aims of the study include: (i) to examine the workplace-employee factors in the adoption of electronic mail, (ii) to explore the relationship between e-mail and organizational measures of employee participation, and (iii) to investigate the training practices of establishments with the e-mail facility.

The article first provides an assessment of the study objectives, and then discusses regression results from WERS98. The final section discusses the limitations of the study and indicates potential areas of future research.

Research Design

The aim of this article is to evaluate the incidence and impact of electronic mail using the 1998 British Workplace Employee Relations Survey (WERS98). The WERS 98 data are designed to be nationally representative of workplaces with ten or more employees. Face-to-face interviews for WERS98 were conducted with a manager (with day-to-day responsibility for employee relations) at 2,191 workplaces, constituting a response rate of 80 per cent. The WERS 98 survey of employees comprises 28,240 observations, constituting a response rate of 64 per cent. The survey questionnaires were distributed to a random selection of 25 workers employed in 1880 of the 2,191 workplaces within the WERS 98 main management survey (or to all employees if the workplaces had 25 employees or less).

Extant literature on the determinants of technological change has been largely concerned with analysing the impact of establishment level factors such as new technology-based task structures on organizational productivity. It seldom employs any workplace and employee information together to examine the relative contribution of employee and establishment level factors to the incidence and impact of new working practices. The present research fills this gap by using the WERS98 dataset, which is a linked survey of workplaces and employees.

Given the nature of the research questions, survey probit or ordered probit modeling techniques are used throughout. It is thus possible to hold constant a range of workplace and individual level characteristics, while the relationships between the dependent and independent variables are analyzed. These techniques also enable the probability of respondents' selection into the sample and the design of the survey of employees to be taken into account. To estimate the determinants of e-mail use, the following generalized reduced form equation is estimated:

$$Y^* = B' \text{ Est} + \beta' \text{ Emp} + \epsilon$$

where:

Y^* denotes establishments with the e-mail facility. Est includes establishment related variables; Emp includes employee measures; and ϵ is an error term. Probability weights are used in all regressions. The particular tests of the incidence and impact of e-mail based channels of internal communications are the following.

The Incidence of E-mail-based Channels of Communications

A major goal of e-mail-based communications strategy is to ensure that technology makes an effective contribution to the development of an integrated workforce and to assist progress towards enterprise competitiveness [19, 21]. The article first examines the types of workplaces that have introduced electronic mail, and considers whether there are certain types of workplaces in which the utilization of e-mail is significantly poorer than others. The results should be of particular interest to practitioners, as they

will identify the types of workplaces that are less likely to have sought new communications methods. We first provide a brief assessment of the factors that are expected to influence the adoption of e-mail by the workplaces studied as part of their internal communications strategy.

A general observation is that educated workers are more likely to participate in new technological innovations such as electronic forms of internal communications than their relatively less educated counter-parts. To put this observation in its right economic context, we need to consider the current climate of employment and wage practices.

The last two decades have seen major changes in the demand for skilled workers in industrialized countries. There are three discernible trends: first is the growth of non-manual wages and employment relative to manual workers. This is accompanied by the position of the unskilled, relative to the skilled, becoming worse. Bartel and Lichtenberg use a panel of manufacturing industries from 1960 to 1980 to find that the implementation of new technologies, proxied by the age of the capital stock, increases the share of the highly educated in total labor costs [4]. At the same time, the employment decline among manual workers has been disproportionately concentrated among unskilled workers. Finally, there is the evidence of a widening wage inequality within skill categories (including the unskilled) [18].

Since the number of educated workers in the labor force has increased overall, it should have normally driven down wage differentials. This is obviously not what has happened. It has then been argued that education has become more valuable in periods

of rapid technological change; that it takes more education to cope with the constraints imposed by new production systems. This has led many authors to conclude that technology and human capital are relative complements [1, 13]. Thus, technological innovations always serve to create demands for educated and skilled workers. It is in this sense that a value-based internal communications strategy would target educated workers because they are more likely to benefit from technological advances in production. Similarly, the type of worker contract (e.g. fixed term or temporary), gender and occupations may also be relevant in the decisions of organizations to introduce electronic mail.

A number of empirical studies show that the establishment's size is an important determinant of the incidence of information sharing [2]. Some occupations (e.g. skilled manual workers and sales occupations) are also more engaged in technologically-intensive or multiple-type operations, and the establishments employing them can be expected to report higher incidence of electronic mail. The type of industrial sector is also a relevant factor in affecting the degree to which internal communications can contribute in the value creation process. Education and health sectors have one of the highest probabilities of adopting sophisticated technologies. The industrial relations system may also influence internal communications strategy. To the extent that unions promote measures that act to stabilize employment, they may strengthen incentives to resist change [15]. We may therefore see a negative relationship between trade unions and email initiatives if this effect is strong.

To investigate these relationships, a dichotomous dependent variable is created (where 1 = 'e-mail workplaces', and 0 = 'non-e-mail workplaces'). The objective is to regress a range of independent variables concerning workforce characteristics onto this dependent variable so as to identify the types of workplace that are more/less likely to have introduced electronic mail as a method of internal communications. A full listing of the variables used is provided in Table 1. A similar analysis is undertaken by using employee data to identify employee characteristics that are more/less likely to be associated with the use of email facility (Table 2 contains all variables used).

The Relationship Between Electronic Mail and Job Control

Organizations embracing electronic mail as part of internal communications systems are likely to dismantle many of the features of control-based organizational systems and introduce measures that will provide better variety and control over the work itself. This is based on the assumption that new communications technologies encourage wider information-sharing in the workplace, and thus allow a greater role for employees in the decision-making process. The second aim of this article is therefore to test whether workplaces with electronic mail facilities are indeed more likely to have adopted activities associated with greater employee control than are their counterparts without electronic e-mail. A brief description of recent organizational changes aimed at introducing flexible management practices may shed light on the direction of our empirical results.

A number of stylized facts can be used to describe specific features of flexible organizational practices. For example, there are strong indications that different organizations hire different quality workers. The catering industry can be cited as a relevant example in that restaurants come in a range of quality levels. McDonald's will not hire famous chefs, and Maxim's will not hire teenage waiters. Systematic differences in product quality, associated with differences in employees' skills, are a plausible explanation of why different types of restaurants employ workers with different levels of skill. Similarly, one finds a positive correlation among the wages of employees in different occupations within an organization. Secretaries working for investment banks earn more than their counterparts in retail banks. This happens because the secretary's wage in an investment bank correlates with one of the investment manager's.

This suggests that workers of different skill-levels are imperfect substitutes, and that output is more sensitive to skill in some tasks than in others. As a result, organizations tend to specialize in one skill level or the other, rather than employing workers with all skill types. This then creates the incentives for the segregation of workers in different sets of organizations, as the complementarity between the tasks promotes self- (i.e. assortative) matching (consider, for example, the case of Microsoft). New information technology has, in particular, spurred the move toward the complementarity of tasks. Strategies such as flat hierarchies, restructuring, horizontal networking and team-building appear to be responding to these changes. We therefore hypothesize that:

H1: The use of e-mail will be positively related to organizational measures of employee participation.

To evaluate this hypothesis, a dichotomous independent variable (where 1 = 'e-mail facility', and 0 = 'no -email facility') is regressed onto three dependent variables.

These are, firstly, the extent to which employees in the largest occupational group have discretion over how they do their work (on a scale of 1 to 4 where 1 = 'none' and 4 = 'a lot'; mean score 2.19); secondly, the extent to which employees in the largest occupational group have control over the pace at which they work (on a scale of 1 to 4 where 1 = 'none' and 4 = 'a lot'; mean score 2.29); and thirdly, the proportion of employees in the largest occupational group who work in formally designated teams (on a scale of 1 to 7 where 1 = 'none' and 7 = 'all'; mean score 2.91). These equations control for a range of workplace-level characteristics listed in Table 1.

Employee Attitudes and Reports of Training Activity

The success of e-mail as part of an internal communications strategy is critically dependent upon the ability of employees to operate new systems. It is therefore important that, so long as internal communications features prominently in the corporate plans, organizations fully incorporate training and learning activities in their employee development strategies. The third aim of this article is to use the WERS 98 survey of employees to compare employee attitudes towards training and employee reports of training activity in 'e-mail' and 'non -e-mail' workplaces.

While the advocates of the use of electronic mail in internal communications are keen to see its wider use, there are some perceived disadvantages that would need to be resolved before such methods can be commonly applied as part of an internal communications strategy. For workplaces that have got over the barrier of getting employees proficient at using e-mail, the next step is to address the management of email. Specifically, misuse and poor management of email can manifest themselves in a number of ways. For a so-called 'fast' means of communication, people spend a great deal of time composing, sending, receiving, reading, filing and deleting email. Apart from the security risk and legal exposure, other problems can involve miscommunication and misinterpretation of email messages, poor time management and harassment. These issues can only be effectively dealt with by providing training in the use and management of communication technologies. However, any training decision must be made keeping in view the organization's overall employee development strategy, as considerable costs may be involved in taking this particular course of action. Our next hypothesis therefore states that:

H2: Organizations with the e-mail facility will have higher levels of training activity.

In order to evaluate this issue, a dichotomous independent variable (where 1 = 'employees in e-mail workplaces', and 0 = 'employees in non-e-mail workplaces') is regressed onto three dependent variables. These are: firstly, the amount of training the employee has received in the 12 months prior to the survey being undertaken, either paid for, or organized by the employer (on a scale of 1 to 6 where 1 = 'ten days or more' and 6 = 'none'; mean score 2.88); secondly, whether the employee has discussed their training needs with their supervisor/line manager in the 12 months

prior to the survey being undertaken (dichotomous variable: 51 per cent of employees have had such discussions); and thirdly, whether the employee agrees with the statement that ‘people here are encouraged to develop their skills’, on a scale of 1 to 5 where 1 = ‘strongly agree’ and 5 = ‘strongly disagree’; mean score 2.66). All of these equations include controls for the employee characteristics listed in Table 2.

Discussion of Results

The Incidence of Electronic Mail Uptake

The results provided in Table 1 report the coefficients and standard errors from the probit equation, as well as the magnitude of the effect of workplace characteristics on the probability of uptake of electronic mail. The procedure followed is to report first the probability of electronic mail for a ‘benchmark’ workplace, and then vary the workplace characteristics *one at a time* to see how they influence the uptake probability of electronic mail. There are 48 per cent of workplaces with e-mail systems in the sample under investigation.

Table 1 about here

The factor that appears most significant in deciding whether an electronic mail facility is introduced is organizational size. The benchmark probability of electronic mail increases by 43 per cent when it is recalculated using large size establishments (i.e. more than 10,000 employees) as opposed to workplaces that are part of a smaller organization (with all other variables staying the same). Within the samples surveyed,

as organizational size increases so does the probability that the organization would adopt an electronic mail system. Smaller establishments are less likely to have introduced electronic-based systems of internal communications. The magnitude of the effect is not inconsiderable. For example, the probability of e-mail uptake falls by –14 per cent, from 0.328 for the benchmark workplace to 0.234 when it is recalculated using workplaces with 50-199 employees as opposed to 200-499 employees (keeping all other variables the same). This is a somewhat surprising result as it is generally assumed that small size workplaces are more likely to use innovative practices to stay competitive in their particular markets. However, since the costs of setting up electronic mail systems are considerably higher for small establishments, it is likely that they are sometimes held back from taking this expensive route.

A considerable degree of variation in the probability of uptake of e-mail by industry sector is also apparent from Table 1. The recalculation of the benchmark probability of uptake by using workplaces in the electricity, gas and water supply sector as opposed to manufacturing (with all other characteristics staying the same) shows that the probability increases by 77 per cent. Similar trends are found when other sectors are used: for instance, it increases by 56 per cent when the education sector is used, by 46 per cent when the financial intermediation sector is used, and by 41 per cent when the real estate and renting sector is used. Sectors such as construction, hotels and restaurants, public administration, defense and social security, and health and social work experience the opposite trend of a decreasing probability of email uptake.

Unions are found to have a negative effect on the adoption of new technology. This is in line with our earlier discussion of the role of unions in organizational change and

development. Because unions represent the interests of its members, and since many workers may be reluctant to change their old routines, it is not surprising that unions oppose the introduction of new technological systems.

Although competition in the market does not seem to have a significant effect on the probability of uptake, workplaces with a limited market share and those who have not been in the market for very long (i.e. operating for less than five years) have a higher probability of uptake. Indeed, the probability of e-mail uptake increases by 24 per cent, from 0.328 for the benchmark workplace to 0.407 when it is recalculated using workplaces with market share of 5-10% as opposed to workplaces that occupy a larger market share (with all other characteristics staying the same). It would seem that workplaces with a smaller market share recognize the need to adopt more efficient organizational practices, especially if they are to grow and control a better part of the market.

The same is the case with younger establishments – the likelihood of e-mail uptake increases to 32 per cent when the benchmark probability is recalculated using workplaces operating for less than five years as opposed to workplaces operating for more than five years. This is probably due to the fact that younger workplaces are more willing (at least in some sectors of the economy) to experiment with new technologies than the older ones. They might also find it easier to adopt new management practices, as many of their technologies and associated organizational practices are relatively new and therefore there is less chance of vested interests emerging to resist change.

Table 2 about here

Table 2 provides details of the uptake of electronic mail systems using employee-level data. A range of variables for individual human capital, demographic information, and current features of the employee's job were included in the regressions. The results show that all three groups of variables are important in explaining the variation in the individual employee's opportunity to participate in new technological systems.

The results demonstrate: firstly, education is the most significant determinant of the uptake of an e-mail system (this may be because educated people are more likely to seek employment in workplaces with electronic mail systems). The benchmark probability of the use of an e-mail facility increases by 25 per cent when it is recalculated using postgraduate education as opposed to no education (with all other characteristics staying the same). This provides a degree of support to a well-known proposition that human capital is a major determinant of new technology adoption [18]. Thus, our predictions related to the role of capital-skill complementarity are largely borne out by these results.

Secondly, similar findings for white collar workers (i.e. manager/senior administrator, professional and associate professional) and high-income bracket workers (i.e. from 12480.5 to 35361) suggests that professional workers and workers at higher income levels are more likely to embrace new technologies. This might either be due to the nature of the work (as top level workers have to communicate more frequently) or because new trends towards greater employee participation (e.g. more use of

briefings) make it necessary to use e-mail as the most convenient mode of communication within the organization.

Thirdly, part time workers are, unsurprisingly, less likely to use e-mail. The benchmark probability of email use falls by 45 per cent when it is recalculated using part time employees as opposed to permanent workers. This is understandable as, in many instances, the use of technological facilities such as e-mail requires some training, and most part-time workers are often excluded from the firm's training programs. This is, however, not the case with fixed term workers.

The relationships between e-mail use and ethnic minority, gender and dependent child are not found to be significant.

The Relationship Between Electronic Mail Application and Measures of Job Control

The analysis of the WERS 98 survey of managers, as reported in Table 3, focuses upon the relationship between e-mail and three measures of job control, i.e. job discretion, job control and work teams. It shows that job discretion and work teams are more commonly practised within e-mail workplaces than in non-e-mail workplaces. It would also seem that innovations in internal communications are part of a larger program of organizational change and development. This can therefore be usefully explored as a distinctive element of the change process designed to move away from traditional hierarchical organizational systems toward the flexible, integrative coordinative arrangements in modern organizations.

Table 3 about here

The critical advantage perceived for hierarchical organizational systems associated largely with mass production systems was the principle of 'economies of scale' that permitted a steep decline in unit costs when volume output was increased. One result of employing such production systems was that jobs were broken down into small minute tasks, so that they could be repeated an infinite number of times by operational workers. The lack of any relationship between skill or employee effort and the final outcome meant that employees had little to gain from learning the mechanics of the technology employed, as in this type of system only maintenance or installation staff need to know about the complete operation of the production line [7].

Flexible work organizations, or integrated manufacturing systems, on the other hand, are likely to preserve the significant role of individual employee skill in the production process [17]. Special attention is also accorded to developing norms that enhance cooperative effort, because the effective implementation of many new productive processes critically depends on team members' initiative and feedback. Such an integrative process is greatly facilitated by the introduction of streamlined internal communications systems such as electronic mail. The WERS 98 survey of managers demonstrates that the use of e-mail helps facilitate organisational change aimed at better employee control over the jobs they perform and the enhancement of the team environment. This is most probably achieved by strengthening the information-sharing arrangements within the workplace so as to maximise the benefits accruing from employee participation.

Reports of Training Activity

As demonstrated by Table 4, employee reports and attitudes towards training activity are more favourable in e-mail workplaces than in non-e-mail workplaces. Firstly, employees within electronic mail workplaces report having received more days training by their employer in the 12 months prior to the survey being undertaken than do their counterparts in non-e-mail workplaces. Secondly, they are more likely to have discussed their training needs with their supervisors or line managers. Thirdly, they respond significantly more positively to the question as to whether people at their workplaces are encouraged to develop work-related skills. These findings could be explained by examining the relationship between technology adoption and training decisions. For example, the introduction of e-mail seemed to have spurred the move toward providing employees with higher levels of training and learning opportunities. But it is also indicative of the wider approach taken by many workplaces toward employee personal development.

Table 4 about here

Training and learning is likely to become, within the context of technology adoption such as electronic mail, an important strategy because an improvement in the ability of employees to communicate more effectively, make decisions and solve problems allows a greater exploitation of the functioning of new technology [21]. An approach to learning and training that relies on complementarity between technology and skills thus locates the analysis of training in a wider context. This is because new technological systems are likely to encourage the move toward a broader skill base of

employees as discussed above and therefore organizations will adopt those measures that are aimed at developing multiple skills and greater exploitation of knowledge.

More generally, such an approach suggests that economic and technological conditions have the potential to influence organizations to use the interdependency between technology and skill as a means of developing a new kind of learning approach. One example is the way knowledge management is becoming a major part of the workplace strategy to obtain competitive advantage [16]. Specifically, with the introduction of electronic-based internal communications, it is possible to develop a systematic and integrative approach toward knowledge management and employee development. The results from the WERS data show that workplaces with an e-mail facility are indeed more likely to identify the training needs of employees and take appropriate measures to meet those particular needs.

Conclusions

Internal communications is the core organizational process that enables businesses to engage their people's intellectual and creative assets to produce value [20]. In particular, internal communications can help organizations achieve their strategic objectives by enabling employees to deliver a differentiating proposition to colleagues or customers, making restructuring work, or increasing cross-business collaboration, and innovation. This article explored the link between electronic-based systems of internal communications and various employee and establishment level factors and whether the new systems affect the nature of employee work and their attitudes toward training.

Consistent with a growing body of evidence, a range of educational, occupation and work environment variables were found to have a significant role in explaining the extent to which establishments adopt electronic based channels of communication. For instance, the debate on organizational change has largely taken place without a consideration of the role of specific employee characteristics, which can be critical in determining the extent of employees' participation under a given scheme. There is the possibility that employees are divided into workplaces that offer better working conditions, are more attractive places of employment and are associated with greater opportunities for participation in skill-intensive programs than those that are not. It has previously been suggested that some labor market segments, such as female and ethnic employees, experience reduced levels of personal development opportunities [7]. The results of this study however, do not lend support to these earlier findings.

It is argued that the incentive for organizations to introduce flexibility and employee control over their work is a response to the realization that rigid structures of command and control are no longer relevant in an environment in which employee skill and associated organisational practices, such as information-sharing arrangements are ever more critical for the efficient running of productive activities. Workplaces will therefore introduce measures which particularly enhance the ability of employees to participate fully in the coordination of work. For instance, they will use e-mail as a means to improve the participation of employees in shop-floor decision making or training and personal development. This claim is supported by our positive results on the link between e-mail and various measures of employee job control.

A critical factor determining the effectiveness of e-mail communication is the organization's willingness to provide necessary training to its employees. However, although organizations make training choices in line with their own strategic objectives, they are also fundamentally influenced by many other constraints. These constraints are primarily related to the organization's basic productive activities, but factors such as the general attitude toward training and employee skill development are equally important in determining the role of new technologies in the value-creation process. This study has shown that the use of e-mail can be an effective solution for organizations that initiate an active approach toward training and skill development. Further insights on the link between technology adoption such as an electronic based system of internal communications and specific training decisions can be obtained by undertaking a case study approach.

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Table 1. The uptake of e-mail by workplace characteristics

	Coeff./std error	Marginal impact (% change)	Probability of email uptake
<i>Benchmark workplace:</i> less than 50 employees; manufacturing; local market; UK owned; no competition; less than 5% share; non-union; operating for more than 5 years		-	.328
<i>Change in characteristics from benchmark workplace:</i>			
Reference category: 200-499 employees			
1-49	-0.226 (0.115)	-11	.294
50-199	-0.259 (0.158)	-14	.283
100-199	0.365 (0.312)	+15	.378
500-999	0.391 (0.190)	+22	.401
10000+employees	0.423 (0.265)	+43	.471
Reference category: SIC major group D (manufacturing)			
SIC major group E (electricity, gas and water supply)	0.445 (0.265)**	+77	.581
SIC major group F (construction)	-0.188 (0.072)	-49	.168
SIC major group G (wholesale and retail trade)	-0.192 (0.140)	-15	.281
SIC major group H (hotels and restaurants)	-0.193 (0.196)	-40	.200
SIC major group I (transport, storage and communication)	-0.261 (0.202)	-22	.256
SIC major group J (financial intermediation)	0.403 (0.135)**	+46	.481
SIC major group K (real estate, renting)	0.336 (0.139)	+41	.463
SIC major group L (public admin., defense, social security)	-0.067 (0.067)	-18	.271
SIC major group M (education)	0.408 (0.163)	+56	.512
SIC major group N (health and social work)	-0.150 (0.099)	-45	.183
SIC major group O (other community, social, personal)	0.337 (0.238)	+10	.364
Reference category: Local market			
Regional market	0.335 (0.214)	+13	.371

National market	0.307 (0.196)**	+3	.340
International market	0.421 (0.226)**	+36	.449
Reference category: UK owned			
Predominately UK owned	-0.216 (0.139)**	-15	.282
50/50 UK and foreign ownership	0.400 (0.352)	+28	.422
Predominately foreign owned	0.387 (0.171)	+25	.413
Foreign owned and controlled	0.362 (0.205)**	+38	.454
Reference category: No competitors			
Few competitors	-0.272 (0.169)	-8	.302
Many competitors	-0.262 (0.175)	-20	.265
Reference category: 1-4% market share			
5-10%	0.413 (0.128)**	+24	.407
11-25%	-0.317 (0.117)**	-2	.324
26-50%	0.346 (0.214)	+9	.359
More than 50%	0.293 (0.136)**	-8	.303
Reference category: Non-union			
Union recognition	-0.200 (0.098)**	-28	.237
Reference category: Operating for more than five years			
Operating for less than five years	0.404 (0.176)**	+32	.433
F	4.68		
Prob>F	0.000		
N	12359		

** Significant at 1 per cent, * significant at 5 per cent.

Table 2. The uptake of email by employee characteristics

	Coeff. / std error	Marginal impact (% change)	Probability of email uptake
<i>Benchmark</i>			
<i>employee</i>			
<i>characteristics: no</i>			
<i>qualifications;</i>			
<i>permanent;</i>			
<i>manager/senior</i>			
<i>administrator;</i>			

17420.5 annual pay		-	.305
<i>Change in characteristics from benchmark employee:</i>			
Reference category: No qualifications			
O level	-0.265 (0.033)**	-2	.300
A level	0.293 (0.135)**	+6	.326
Degree	0.341 (0.235)**	+16	.356
Postgraduate degree	0.357 (0.043)**	+25	.382
Vocational qual.	-0.051 (0.018)**	0	.307
Reference category:			
Permanent			
Temporary	0.037 (0.036)	+6	.326
Fixed term	0.187 (0.049)*	+22	.375
Part time	-0.109 (0.027)**	-45	.169
Reference category:			
Manager/senior administrator			
Professional	0.336 (0.067)*	+20	.369
Assoc.profess.	0.332 (0.168)	+27	.390
Clerical	0.309 (0.065)**	+24	.381
Craft/skilled	-0.242 (0.071)**	-24	.233
Personal/protective	-0.144 (0.112)**	-41	.182
Sales	-0.179 (0.071)*	-21	.242
Operative/assembly	-0.144 (0.039)**	-37	.193
Other	-0.142 (0.060)*	-46	.166
Reference category:			
(midpoint) 17420.5 annual pay			
3380.5	-0.076 (0.060)	-50	.155
5270.5	-0.119 (0.054)	-39	.187
8320.5	-0.226 (0.156)	-24	.232
10400.5	-0.204 (0.055)	-13	.267
12480.5	-0.297 (0.116)**	-3	.297
14820.5	0.302 (0.056)**	+3	.317
20540	0.322 (0.059)**	+24	.379
25220.5	0.412 (0.152)**	+43	.437
31720.5	0.504 (0.266)**	+76	.537
35361	0.523 (0.169)**	+97	.601
Ethnic minority	-0.274 (0.044)	-2	.300
Male	-0.213 (0.121)	-11	.272
Dependent child	-0.217 (0.029)	-3	.296
F	3.37		

Prob>F 0.000
n 11861

** Significant at 1 per cent, * significant at 5 per cent.

Table 3. Job experience – survey of managers

	Job Discretion	Job Control	Work Teams
Email facility	0.258 (0.058)**	-0.001 (0.055)	0.159 (0.070)*
<i>Reference</i>			
<i>category: 200-499</i>			
<i>employees</i>			
50-99	-1.594 (0.281)**	-0.260 (0.132)	-1.218 (0.304)**
100-199	-0.258 (0.238)**	0.535 (0.256)**	0.207 (0.112)
200-499	0.112 (0.203)**	1.139 (0.235)**	0.106 (0.259)**
500-999	0.248 (0.225)**	-1.228 (0.241)**	0.494 (0.280)**
10000+employees	0.348 (1.95)**	1.319 (0.230)**	0.128 (0.261)**
<i>Reference</i>			
<i>category: SIC</i>			
<i>major group D</i>			
<i>(manufacturing)</i>			
SIC major group E	0.445 (0.134)**	0.427 (0.126)**	1.293 (0.187)**
SIC major group F	-0.188 (0.218)	1.487 (0.254)**	0.025 (0.235)
SIC major group G	0.750 (0.120)**	0.588 (0.118)**	0.006 (0.130)
SIC major group H	-0.297 (0.169)	0.234 (0.167)	-0.074 (0.179)
SIC major group I	-0.261 (0.142)	-0.299 (0.130)*	0.067 (0.160)
SIC major group J	0.730 (0.115)**	0.766 (0.112)**	0.430 (0.134)**
SIC major group K	1.194 (0.126)**	1.050 (0.120)**	0.065 (0.128)
SIC major group L			
SIC major group M			
SIC major group N	1.310 (0.304)**	1.619 (0.340)**	0.284 (0.341)
SIC major group O	0.364 (0.228)	-0.474 (0.211)*	-0.591 (0.215)**
<i>Reference</i>			
<i>category: Local</i>			
<i>market</i>			
Regional market	0.102 (0.095)	-0.121 (0.091)	0.276 (0.126)**
National market	0.212 (0.081)**	0.189 (0.078)	0.376 (0.101)**
International	0.357 (0.103)**	0.316 (0.103)**	0.248 (0.120)**
market			
<i>Reference</i>			
<i>category: UK</i>			
<i>owned</i>			
Predominately UK	0.186 (0.110)**	0.330 (0.104)**	0.470 (0.141)**
owned			
50/50 UK and	0.457 (0.242)	-0.422 (0.205)*	0.127 (0.263)
foreign ownership			
Predominately	-0.087 (0.140)	-1.158 (0.148)**	-0.631 (0.145)**
foreign owned			
Foreign owned and	0.200 (0.083)*	0.127 (0.078)	-0.048 (0.096)
controlled			
<i>Reference</i>			
<i>category: No</i>			

<i>competitors</i>			
Few competitors	-0.274 (0.152)**	-0.393 (0.133)**	-0.170 (0.173)
Many competitors	-0.355 (0.158)**	-0.232 (0.137)**	0.084 (0.176)
<i>Reference</i>			
<i>category: 1-4%</i>			
<i>market share</i>			
5-10%	0.420 (0.102)**	0.266 (0.098)**	0.032 (0.120)
11-25%	0.008 (0.099)	0.146 (0.097)	0.009 (0.115)
26-50%	0.314 (0.101)**	-0.031 (0.096)	0.406 (0.124)**
More than 50%	0.347 (0.113)**	0.221 (0.108)*	-0.267 (0.125)*
<i>Reference</i>			
<i>category: Non-</i>			
<i>union</i>			
Union recongnition	-0.068 (0.076)	0.075 (0.073)	0.156 (0.083)
<i>Reference</i>			
<i>category:</i>			
<i>Operating for more</i>			
<i>than five years</i>			
Operating for less	0.383 (0.120)**	0.171 (0.107)	0.255 (0.142)
than five years			
F	5.43	2.19	4.27
Prob>F	0.000	0.371	0.000
n	12285	12287	12290

** Significant at 1 per cent, * significant at 5 per cent.

Table 4. Training activity – survey of employees

	Training	Training needs	Skill Development
Employees in email	0.116 (0.025)**	0.260 (0.032)**	0.444 (0.027)**
workplaces			
<i>Reference</i>			
<i>category: No</i>			
<i>qualifications</i>			
O level	0.014 (0.050)	0.062 (0.062)	0.084 (0.052)
A level	0.077 (0.053)	0.086 (0.065)	0.174 (0.054)**
Degree	0.132 (0.054)*	0.076 (0.067)	0.135 (0.056)*
Postgraduate	0.041 (0.063)	0.035 (0.078)	0.076 (0.065)
degree			
Vocational qual.	0.136 (0.025)*	0.168 (0.032)**	0.010 (0.026)
<i>Reference</i>			
<i>category:</i>			
<i>Permanent</i>			
Temporary	-0.230** (0.080)	-0.427 (0.097)**	-0.051 (0.082)
Fixed term	-0.160* (0.065)	-0.261 (0.079)**	-0.004 (0.067)
Part time	-0.273 (0.045)**	-0.123 (0.054)*	-0.071 (0.046)
<i>Reference</i>			
<i>category:</i>			
<i>Manager/senior</i>			
<i>administrator</i>			
Professional	0.018 (0.040)	0.035 (0.050)	0.175 (0.041)**
Assoc.profess.	-0.012 (0.044)	0.241 (0.057)**	0.270 (0.045)**

Clerical	-0.236 (0.039)**	-0.012 (0.049)	0.405 (0.041)**
Craft/skilled	-0.167 (0.072)*	-0.278 (0.087)**	0.298 (0.074)**
Personal/protective	0.325 (0.070)**	-0.032 (0.087)	0.043 (0.073)
Sales	-0.225 (0.064)**	0.048 (0.080)	0.240 (0.066)**
Operative/assembly	-0.542** (0.083)	-0.647 (0.099)**	0.351 (0.084)**
Other	-0.584 (0.078)**	-0.687 (0.093)**	0.259 (0.079)**
<i>Reference</i>			
<i>category: annual</i>			
<i>pay 17420.5</i>			
<i>(midpoint)</i>			
3380.5	-0.083 (0.103)	0.083 (0.126)	-0.091 (0.105)
5270.5	0.066 (0.091)	0.122 (0.111)	-0.156 (0.092)
8320.5	-0.033 (0.093)	0.125 (0.114)	-0.060 (0.095)
10400.5	0.018 (0.089)	0.077 (0.109)	-0.024 (0.090)
12480.5	0.035 (0.088)	0.093 (0.108)	-0.043 (0.090)
14820.5	0.082 (0.087)	0.140 (0.108)	-0.088 (0.089)
20540	0.040 (0.087)	0.186 (0.108)	0.026 (0.089)
25220.5	0.016 (0.088)	0.220 (0.109)*	-0.035 (0.090)
31720.5	0.031 (0.092)	0.113 (0.114)	-0.062 (0.094)
35361	-0.035 (0.092)	0.086 (0.113)	-0.170 (0.094)
Ethnic minority	-0.116 (0.060)	0.088 (0.076)	0.160 (0.061)**
Male	-0.008 (0.026)	0.034 (0.033)	-0.064 (0.027)*
Dependent child	-0.010 (0.035)	-0.012 (0.044)	-0.037 (0.036)
F	4.81	3.57	2.14
Prob>F	0.273	0.000	0.000
N	11823	10366	11039

** Significant at 1 per cent, * significant at 5 per cent.