Relationships Between Job Skills and Performance: A Study of Webmasters

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ABSTRACT: The main purpose of this study is to determine the mix of organizational and technical skills demanded of Webmasters, and the degree to which those skills influence job performance. The study is composed of two parts. First, a job-content analysis of 800 Webmaster positions is conducted in order to determine the mix of skills demanded of Webmasters by employers. Second, a survey of 232 Webmasters is conducted to test the relationships between those skills and job performance. The job-content analysis suggested that employers seek technical skills over organizational skills, and, in contrast, the survey results showed that Webmasters regard organizational skills as more important in performing their jobs. Structured equation modeling on the survey data showed that deficiency in both technical and organizational skills leads to lower job performance. Moreover, the effect of organizational skill deficiencies on job performance was found to be larger than that of technical skill deficiencies. For researchers, the establishment of an empirical link between job skills and job performance opens the field to further research in the skills of information systems personnel. For employers, the results suggest more attention should be paid to attracting organizational skills when recruiting information systems personnel, such as Webmasters.

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THE RESEARCH COMMUNITY has long been involved in studying the skills and knowledge required by information systems (IS) professionals to do their jobs effectively. Although the focus of some educational programs has been on developing technical skills, many research studies have concluded that a mix of technical and organizational skills provides the optimum configuration [14, 30]. Similarly, trade journals have published articles citing the increased need for IS professionals with significant managerial and interpersonal skills—often bemoaning their absence. Recent articles have echoed this absence in the Internet professional community [44].

Internet professionals are some of the newest examples of IS personnel. Both share a responsibility for the management of technology and information within the firm. Webmasters are examples of Internet professionals (others include programmers, online service representatives, and end-user support personnel). The position of "Webmaster" has been singled out in a number of trade journals as one that has traditionally overemphasized the need for technical skills and underemphasized the need for organizational skills [36, 53]. An overemphasis on technical skills, coupled with an underemphasis on organizational skills, so the argument goes, leads to lower-performing Webmasters. Professional Webmaster communities, such as the International Webmaster Association (www.iwanet.org), the World Organization of Webmasters (www.wow.org), and the Association of International Professionals (www.Webmaster.org), have also recognized this skill deficiency as a problem.

This study is focused on two objectives. The first objective is to better understand Webmasters by building a constitutive profile of the position. Although a number of definitions exist that explain what a Webmaster does, the authors could find none that identify the specific skills and knowledge Webmasters require in order to fulfill their job requirements. A job-content analysis is undertaken to classify the skills employers seek in Webmasters. Specific attention is paid to the mix of technical versus organizational skill components. The results of the job-content analysis are then compared with Webmasters' own determinations of their skills and knowledge requirements.

The second objective of the study is to determine how technical and organizational skills affect a Webmaster's job performance. A survey methodology is employed to measure two factors related to each technical and organizational skill. First, each Webmaster is asked to rank the *usefulness* of a skill, then his *proficiency* in that skill. The difference between these values can be viewed as that individual's perceived *deficiency* or *surplus* in the skill. For example, an individual might recognize that the need to communicate effectively is important to his job, but also recognize that he is not very good at it. The difference between how important the individual feels communication is, and how well he actually communicates, represents a perceived com-

munication skill "shortfall" or "deficiency." Skill deficiencies and surpluses over a wide variety of technical and organizational skills are then related to measures of perceived job performance. Partial least squares (PLS) is employed to model this relationship.

Information Systems Skills Research

THE CONCEPTUAL FOUNDATION OF THIS STUDY is rooted in the IS skills literature. The IS field has a rich literature on the subject of "requisite" skills for IS personnel. Several studies have looked at the skill requirements of IS personnel [6, 7, 12, 13, 17, 26, 30, 34, 37, 39, 60, 62]. A common finding of these studies is that skill requirements for IS personnel change over time, both in terms of technical and organizational skills [6, 12, 13, 26].

Since the 1950s and early 1960s, when information systems began to appear in organizations and groups of technicians were organized into functional departments, the importance of IS personnel being business literate has been recognized [1, 9, 15]. As IS took on a larger role in organizations, and cut across functional areas, the need to understand the business processes became increasingly important.

Zmud [61] suggested that IS personnel required some degree of skill in six general areas: organizational overview, organizational skills, target organizational unit, general IS knowledge, technical skills, and IS product skills. The first three can be broadly defined as organizational skills and the latter three as technical skills. Lee et al. [30] identified four IS personnel skill categories, two of which were technical and two organizational: technical knowledge/skills, technology management knowledge/skills, business functional knowledge/skills, and interpersonal and management knowledge/skills. A study based on this classification found that technology management, interpersonal, and functional management skills were more important than technical skills to the job function of individuals in the sample. The study also found that, over time, organizational skills would become more critical to the IS job function.

These findings are consistent with prior studies based primarily on the Delphi surveys for issue generation and rankings/ratings [3, 10, 40]. These surveys, which poll IS professionals at regular intervals about key IS issues, show a clear trend toward organizational rather than technical issues. In a study to identify information technology (IT) competencies that lead to sustained competitive advantage using a resource-based perspective, Mata et al. [33] found that only IT management skills qualified, whereas IT technical skills did not.

Research has shown that the mix of technical and organizational skills needed by IS personnel varies with position [23, 61]. Programmers tend to need primarily technical skills, whereas systems analysts need more of a mix of technical and organizational skills. IS managers require a higher level of organizational ability [7, 12]. There has been very little published research, however, that looks at Internet professionals' skills in general, and Webmasters' skills in particular [49]. The question of what skills and abilities make up the Webmaster position will be addressed later in the paper.

In summary, recent research literature has found that IS personnel perform better with a mix of technical and organizational skills. Although the need for technical skills remains high, the trend seems to point toward more organizational skills for IS personnel.

Skill Proficiency, Deficiency, and Surplus

PROFICIENCY HAS BEEN DEFINED AS THE ABILITY to use a knowledge or skill. A number of studies have attempted to identify the variables that best predict proficiency [19, 37], whereas others have concentrated on the measurement of proficiency in one or more skill areas [7, 12, 13, 24, 37, 38]. Although proficiency is a useful indicator of skill level, it is not necessarily a good indicator of performance. In order to have an effect on performance, the proficiency must be put in context. Questions needed to be addressed, such as whether the proficiency is "good enough" for the task, how it ranks with the proficiencies of competitors, and whether the proficiency is in an area relevant to the task.

Researchers have measured *deficiency* and *surplus* by connecting a measure of proficiency in a skill with a measure of "usefulness" of that skill (usually related to job performance) [7, 24, 37, 38]. An employee's deficiency or surplus in a particular skill can be represented by a function of both usefulness and proficiency. More specifically, deficiency can be defined as the difference between the usefulness of a skill and an individual's proficiency in that area [37]. For example, for Webmasters, the ability to program in HTML is very important, thus a Webmaster with a low proficiency in HTML programming will have a skill deficiency. By the same token, a skill surplus can be defined as the difference between an individual's proficiency in a skill and the usefulness of that skill to successful job performance. A COBOL programmer entering a UNIX environment might be in the position of a "COBOL" skill surplus. In theory, the larger the difference between usefulness and proficiency, the higher the deficiency or surplus. When usefulness of a skill and proficiency in that skill are equally weighted, then a skill "balance" results.

Nelson [37] divided IS personnel and end users into six skill and knowledge categories based on the earlier work of Zmud [62]. Nelson developed an instrument to measure these six areas and conducted an empirical study to test IS personnel and end users' relative levels for each skill and knowledge dimension. The results of the study showed that IS personnel were deficient in organizational skills and knowledge, whereas end users were deficient in IS skills and knowledge. Although Nelson concluded that skill and knowledge surpluses were theoretically possible in addition to deficiencies, he found no empirical evidence of a skill surplus in his study.

No previous studies could be found that tested a link between skill deficiency or surplus and performance. Although Nelson related skill deficiency to educational needs and, by inference, to performance of IS personnel and end users, he did not actually test this relationship [37]. Nevertheless, there are a number of *a priori* reasons to suppose that a skill mismatch (either a surplus or deficiency) might lead to

poor performance. If a skill is important to a job function, an employee with little proficiency in that skill might be expected to perform poorly (a skill deficiency). Conversely, an employee might be overqualified to perform a task of little importance (a skill surplus), and consequent feelings of boredom or frustration may lead to lower performance.

Based on the prior literature in IS skills, three sets of propositions are developed. The first set of propositions deals with the link between organizational skills and job performance. An employee is deemed to be deficient in a skill if her proficiency in a skill is lower than the usefulness of that skill to the position.

> **Proposition 1a:** *An organizational skill deficiency will lead to lower job performance.*

Conversely, an employee is deemed to have a surplus in a skill if her proficiency in a skill is higher than the usefulness of that skill to the position.

> **Proposition 1b:** *An organizational skill surplus will lead to lower job performance.*

The second set of propositions makes an association between technical skills and job performance.

> **Proposition 2a:** *A technical skill deficiency will lead to lower job performance.*

And,

> **Proposition 2b:** *A technical skill surplus will lead to lower job performance.*

The third set of propositions concern the case when the usefulness and proficiency of a skill are in "balance." A balance occurs when an employee's level of proficiency in a skill is approximately equal to the usefulness of that skill to the employee's job. This proposition can be viewed as an extension of propositions one and two. If a usefulness/proficiency "mismatch," causing either a skill deficiency or surplus has a negative effect on performance, then it follows that a usefulness/proficiency "match" would have a positive effect. Hence,

> **Proposition 3a:** *An organizational skill balance will lead to higher job performance.*

And,

> **Proposition 3a:** *A technical skill balance will lead to higher job performance.*

These propositions represent an extension of the conceptual and empirical work in IS personnel skills. This literature has established that skills and abilities can be viewed in terms of deficiencies and surpluses. These deficiencies and surpluses, in turn, are a function of the usefulness of a skill and proficiency in that skill. This study extends this work by proposing a conceptual link between skill surpluses, deficiencies, and job performance. The remainder of the paper outlines a study that examines these propositions using the specific case of Webmasters. First, the Webmaster role, in terms

of required organizational and technical skills, is defined using a job-content analysis. Second, the link between skill deficiencies, surpluses, and job performance is explored using a cross-sectional survey.

The Webmaster Role

IT IS HARD TO IMAGINE A POSITION that has risen to prominence as quickly as the Webmaster. A few years ago, Webmasters didn't exist. Today, they are one of the most sought after positions in the online world. Interestingly, the exact time and place when the term "Webmaster" surfaced can be determined with some certainty. The term first appeared in "Etiquette for Information Providers," one in a series of guides to the World Wide Web (WWW) published by Tim Berners-Lee in 1992 [8]. It is described as follows:

> You should make a mail alias "Webmaster" on the server machine so that people who have problems with your server can mail you about it easily. This is similar to the "postmaster" alias for people who have mail problems with your machine.

From its roots as a support position, the Webmaster soon became involved with the design and management of an organization's Web site. In 1997, Alan Richmond, of the Web Developer's Virtual Library defined the role of the Webmaster as follows:

> A person who manages a web; mediator between web authors and system administrator—ensures that applicable standards such as HTML validity and link liveness are met, optimizes the web architecture for navigability, takes editorial responsibility for the content, quality and style of the site; finds, creates and installs tools to create web content and check consistency; develops and enforces the house style; liaises with graphic artists; provides first level user support.

However, despite frequent updates, defining the Webmaster role is becoming increasingly difficult. As the Internet changes and evolves, so does the role of the Webmaster. In order to adequately define the Webmaster position as it exists today, a job-content analysis was conducted.

The job-content analysis was modeled on the work of Todd et al. [56]. Job descriptions of Webmasters from "help wanted" advertisements were analyzed over a six-month period from June to November 1999. Two trade journals (*Computerworld* and *Informationweek*) and five online job search indices (www.monster.com, www.computerjobs.com, www.jobengine.com, www.jobs-online.com, and www.peoplesearch.com) were tracked by the authors over the study period. All job descriptions for Webmasters posted during the study period were included in the analysis. In total, 800 job descriptions were analyzed.

The results of the job-content analysis are shown in Table 1. Although 97 percent of job placements sought technical skills, only 57 percent sought any kind of organizational or management skills. Not surprisingly, by far the most frequently sought-after skill was the ability to program in HTML (83 percent of placements specifically re-

Table 1. Job Content Analysis

Skill/Ability/Knowledge	Skills Mentioned in Job Posting (n = 800)	Percentage of Total
Technical skills		
General technical skills	773	97
HTML	665	83
JavaScript	519	43
Perl	346	24
Windows environment	158	20
Active Server Pages (ASP)	129	16
Java	161	13
UNIX environment	107	11
Visual Basic	79	10
Network protocols	133	11
Other	89	21
Organizational skills		
Communication skills	267	33
General management skills	161	20
Ability to work in teams	83	10
Project management skills	79	10
Working with end users	25	3
Customer service skills	24	3
Other	15	2
Some organizational skill	453	57

quired this ability). Beyond this requirement, employers sought a mix of technical skills, the most prominent of which was the ability to program in Javascript, Perl, and Java, and being familiar with a Windows and Unix environment. Job descriptions contained an average of six sought-after technical skills.

The most frequently sought-after organizational skill was the ability to communicate effectively, which appeared in one-third of job placements. Thereafter, general management skills (20 percent), the ability to work in teams (10 percent), and the ability to manage projects (10 percent) were the most sought-after organizational skills. The average number of organizational requirements in the job advertisements was one. Technical requirements outnumbered organizational ones by a margin of six to one.

The results of the job-content analysis show that employers view the role of the Webmaster primarily as a technical one. Ninety-five percent of advertisements sought a "technical" person with some or no organizational skills, whereas five percent looked for a "manager" with some technical skills. Only two percent of job placements required any kind of professional business, management, or organizational qualification, such as a business degree or diploma. Interestingly, these findings appear to be in conflict with the research in IS skills reviewed earlier, which suggested that, although the need for technical skills remained high for IS personnel, the need for organizational skills was growing in magnitude and importance.

A number of tests were carried out to determine whether the sought-after mix of technical and organizational skills showed a bias along predictable dimensions. Specifically, salary levels and work experience were analyzed. Of the 800 job descriptions studied, 245 provided salary levels or ranges. These salary levels were divided into three categories—low, medium, and high. The low category was defined as being less than one standard deviation from the mean value, the medium category was defined as being between one standard deviation under and one standard deviation over the mean, and the high category was defined as being greater than one standard deviation above the mean. Correlations between the mix of skills in each category were conducted to determine whether the sought-after mix of technical and organizational skills differed among the three groups. Interestingly, no significant differences were found (the weakest correlation, between the low and high salary ranges, was 0.735, and was not significant at the $p = 0.1$ level). This result would seem to suggest that no price premium is offered for a particular mix of organizational and technical skills. Webmasters who possess organizational skills command no salary premium over those who do not.

Of the 800 job descriptions studied, 659 specified minimum levels of work experience. Again, work experience levels were divided into three categories—low, medium, and high—based on standard deviations around the mean values. Correlations among the categories were conducted to determine whether the amount of work experience affected the mix of sought-after skills. The results showed that, although job descriptions requiring a high level of work experience also required more organizational skills than job descriptions requiring low or medium levels of work experience, this difference was not significant ($r = 0.679$, $p = 0.31$).

Attempts to control for salary levels and work experience failed to explain the mix of skills required by Webmasters in the job descriptions studied. A high number of technical requirements coupled with a low number organization skill requirements was consistent among all salary ranges and amount of work experience.

The job-content analysis suggests that Webmasters (at least as perceived and hired by employers) are primarily technical positions with limited organizational skills. It should be noted that job descriptions only form a part of the hiring process and that employers may choose to understate or overstate particular skill and knowledge requirements for strategic purposes. One such purpose may be the "gatekeeper effect," where employers overstate technical skills at the beginning of the hiring process in order to narrow the field, and then make determinations of organizational skills and knowledge levels at later stages, such as during face-to-face interviews. Despite some drawbacks, job-content analyses have been shown to be powerful tools to understand job positions of IS personnel [56].

In order to cross validate the findings of the job-content analysis, interviews were conducted with seven key stakeholders. These stakeholders consisted of three Webmasters, three managers who had hired Webmasters in the past 12 months, and the executive director of a professional Webmaster association. The stakeholders were asked to rate the relevance and applicability of the set of skills and abilities identified in the job-content analysis. In general, all respondents confirmed that the skills and abilities generated in the job-content analysis accurately reflected the Webmaster

position. Although the importance of various skills was debated, the list of skills was not.

When asked about a gatekeeper effect, two of the three managers replied that, in their experience, such an effect was minimal in the context of Webmasters. The third acknowledged that the effect existed, but that it was used primarily to guard against obvious personality or culture-fit conflicts rather than the presence or absence of certain skills and abilities.

Research Hypotheses

TO SUMMARIZE, THE LITERATURE has distinguished between organizational skills and technical skills for IS professionals. Based on this research, several propositions were developed that relate specific skill characteristics (such as deficiency and surplus) to job performance. In order to empirically examine these propositions, a survey-design methodology was adopted. Webmasters were used as a sample group and specific hypotheses were developed to represent each proposition. The job-content analysis determined that employers seek Webmasters with a strong base in technical skills and a modest background in organizational skills. The current section of the study seeks to determine the effect this mix of skills has, if any, on the job performance of Webmasters.

Four sets of hypotheses were generated that apply the propositions described earlier to the current research context. These hypotheses are shown in Table 2. The first three sets of hypotheses map closely onto the first three sets of propositions, relating skill deficiencies and surpluses to lower job performance, and a skill balance to higher job performance. The fourth set of hypotheses specifically compares the effect of technical and organizational skills on job performance. Research cited earlier suggests that organizational skills are playing an increasingly important role in the work of IS personnel. The job-content analysis showed that technical skills were in much greater demand (6:1) than organizational skills. It follows, then, that job incumbents must necessarily possess these skills if they were successful in securing their positions. Nevertheless, they also acknowledge the importance of organizational skills to performance of the job once in place. This is also supported by the research cited. Thus, those Webmasters not possessing sufficient organizational skills might well find themselves unable to successfully execute the duties of their positions, irrespective of their technical aptitude. As such, a deficiency in organizational skills might have a greater effect on their perceived job performance than would a deficiency in technical skills.

Research Methodology

A WEB-BASED QUESTIONNAIRE APPROACH was selected as the means to collect data for examination of the hypotheses. This section describes how the questionnaire was developed, tested, validated, and distributed.

Table 2. Research Hypotheses

H1a:	In the case of Webmasters, a perceived organizational skill deficiency will lead to lower job performance.
H1b:	In the case of Webmasters, a perceived organizational skill surplus will lead to lower job performance.
H2a:	In the case of Webmasters, a perceived technical skill deficiency will lead to lower job performance.
H2b:	In the case of Webmasters, a perceived technical skill surplus will lead to lower job performance.
H3a:	In the case of Webmasters, a perceived organizational skill "balance" will lead to higher job performance.
H3b:	In the case of Webmasters, a perceived technical skill "balance" will lead to higher job performance.
H4a:	In the case of Webmasters, perceived organizational skill deficiencies will have a stronger, negative effect on job performance than perceived technical skill deficiencies.
H4b:	In the case of Webmasters, perceived organizational skill surpluses will have a stronger, negative effect on job performance than perceived technical skill surpluses.

A concern when using e-mail and the WWW as the main method of data collection is with coverage bias. Since only a segment of the population has access to e-mail and the WWW, responses will over-sample that segment while ignoring all others. For this reason, mail and phone surveys are used more often in survey research, despite the advantages of online methods, which include quick turnaround and relatively low cost. In this case, an assumption was made that Webmasters would have access to both e-mail and the WWW, and, therefore, that using this medium for distribution of the questionnaire would not result in any undue coverage error or response bias. The Webmasters contacted for the pilot test corroborated this assumption. As a precaution, potential respondents were given the option of receiving the survey instrument by regular mail. No respondents took advantage of this option.

The first subsection examines how the measures were developed.

Measurement Items

In order to measure an individual's deficiency or surplus in a skill, it is necessary to develop a means for assessing both usefulness and proficiency. This study used self-reported subjective measures of usefulness and proficiency. The relative economy and range of information provided by self-reports leads to their extensive use in the literature. Although objective measures are often preferable, the use of self-reported measures has been defended in a number of contexts [48, 51]. Studies have shown that self-reported measures of abilities and performance levels correlate highly with available objective measures [42] and have been used successfully in a number of studies [31, 51].

The theory of work motivation states that people will be motivated to behave and perform in a manner that is consistent with their self-concept [28]. In other words, an individual's perception of deficiency in a skill may affect that person's behavior. For example, if a Webmaster feels a sense of deficiency working in groups, he might avoid working on team projects. This might, in turn, adversely affect job performance.

The items used to measure *organizational skills* were based on the instrument used by Nelson (1991) [37]. This measure, in turn, was taken from previous research [7, 24, 38]. The measure contains an amalgam of items to determine technology management skills, business functional skills, and interpersonal and social skills, all of which had been researched extensively in the literature [11, 18, 35, 55, 59].

Technical skills have been measured in a number of previous studies [2, 30, 55]. However, each of these studies cautioned against using a standardized test to evaluate technical skills due to the changing nature of technology and the variety of technical positions available. It was decided that, in the specific case of Webmasters, a scale to measure technical skills would be developed to match the skills required by the position. There are a number of methodological concerns with scale development, not the least of which is content validity. For a scale to pass a test of content validity, it must accurately reflect the breadth of the construct being measured. Due to measurement difficulties, content validity is often assumed away or ignored in empirical studies. One method to alleviate concerns over content validity is to conduct a widespread taxonomy of the quality being studied. For skills research, a job-content analysis represents such a taxonomy. It was decided, therefore, that the skills most frequently noted in the job descriptions mentioned earlier in the paper would form the basis of a scale to measure technical skills.

Performance was measured using a combination of perceptual and objective measures. Respondents were asked to evaluate their performance and their contribution to the firm's goals. These responses were considered along with three objective measures: number of direct reports, years in position, and salary level.

Instrument Development and Validation

Once developed, the measurement items were put through a series of tests to determine construct validity and reliability. These tests included an initial review by faculty and graduate students, a queue-sorting process, and a pilot test using members of the sampling frame. Each step in this process, as well as an examination of the finished measurement items, is discussed in this subsection.

As a first step toward validating the measurement instrument, the scale items were reviewed by various faculty members and graduate students. Various changes were made to the structure and format of the questions at this stage. Two questions were removed and changes were made to the performance variables to improve their clarity.

To more formally assess the reliability and validity of the scales, a queue-sorting process was followed. Three graduate students unfamiliar with the study were asked to sort the randomly arranged questions into between one and four piles. They were then asked to label each pile. Two of the three students arranged the questions into

three piles, and the third sorted them into four piles. All three students labeled two of the piles "technical skills" and "success variables." Two students labeled the remaining pile organizational skills, and the other split this pile into two, which were named managerial skills and customer service skills. Due to the slight discrepancy between the responses, one organizational skill scale item was dropped. A subsequent test with two separate graduate students resulted in three piles with appropriate labels.

A pretest of the instrument on 15 Webmasters was then conducted to assess face validity and to further assess the reliability of the instrument. The pretest sample was asked to fill out the survey, making note of any ambiguous or confusing questions or instructions. The authors spent an average of 45 minutes discussing the instrument with 10 of the Webmasters. For the remaining five, discussions were conducted through e-mail and interactive messaging. The results of the pretest led to rewording a number of questions, revising the questionnaire format, and adding text at the beginning of the instrument describing the survey objectives. A section at the bottom of the questionnaire allowing respondents to insert their e-mail addresses to receive more information was also added at this stage.

The final version of the survey contained 22 scale items plus 16 closed-ended demographic questions (see Appendix 1). The measurement items for organizational skills, technical skills, and the performance variables are shown in Table 3. The resulting instrument was tested for reliability using the Cronbach alpha test applied to inter-item scores. The resulting reliability coefficients are presented in Table 3 along with individual item means and standard deviations. The reliability coefficients ranged from a low of 0.73, to a high of 0.79, all within the acceptable range as determined by Nunnally [41].

The primary criterion for discriminant validity is that each indicator must load more highly on its associated construct than on any other construct. In order to determine loadings, the factorial composition of the independent variable scale items was tested using principal components analysis with varimax rotation. The results of this analysis are shown in Table 4. The items loaded onto two factors that corresponded to the measurement scale items of the two constructs, organizational skills and technical skills. Together, the 2 factors accounted for more than 50 percent of the variation in the item.

Instrument Distribution

The survey was developed and distributed following guidelines for online survey methodologies set out by Schaefer and Dillman [47]. In addition to normal survey design and distribution procedures, Schaefer and Dillman recommend a number of steps be taken that are particular to online survey methodologies [29, 47]. A few of these are mentioned here.

The questionnaire was posted on the WWW on a password-protected site. The security screen was necessary to ensure that respondents were part of the sampling frame and that they consented to completing the survey. Once the respondents had input a user name and password, they were transferred to the questionnaire site. All

Table 3. Measurement Items

	Usefulness			Proficiency			Deficiency(+)/Surplus (–)		
Item	Mean	Standard Deviation	Alpha	Mean	Standard Deviation	Alpha	Mean	Standard Deviation	Alpha
Organizational skills									
Communication	6.00	0.98	0.796	5.97	0.83	0.778	0.03	1.10	0.789
People management	5.15	1.68		5.36	0.92		–0.24	1.09	
Work in teams	5.35	1.39		5.74	1.01		–0.40	1.43	
Project management	6.00	1.13		5.74	0.90		0.26	1.03	
Working with end users	5.46	1.43		5.93	0.91		–0.44	1.40	
Customer service	5.70	1.48		5.79	1.01		–0.09	1.50	
Respond timely to end users	5.68	1.34		5.86	1.00		–0.18	1.26	
General management skills	5.54	1.15		5.61	1.19		–0.15	1.34	
Construct mean	5.58	1.32		5.75	0.97		–0.16	1.10	
Technical skills									
Windows	5.40	1.49	0.796	5.98	1.30	0.790	–0.59	1.21	0.762
UNIX	5.16	1.54		4.52	1.98		0.49	1.69	
C++	2.85	1.59		2.26	1.57		0.56	2.00	
Visual Basic	2.87	1.64		2.42	1.84		0.45	1.75	
Java	3.93	1.70		3.14	1.99		0.75	2.10	
HTML	6.60	1.03		6.34	1.24		0.16	0.67	
Perl	4.66	1.76		3.80	1.97		0.87	1.78	
Network protocols	5.12	1.34		5.36	1.46		–0.24	1.46	
General technical skills	5.90	1.17		6.23	0.96		–0.33	1.19	
Construct mean	4.69	1.47		4.50	1.59		0.27	1.54	
Performance									
Job performance 1	5.77	0.96	0.730						
Job performance 2	4.98	1.26							

Items measured on a Likert-type scale from 1 (lowest) to 7 (highest)

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Table 4. Principal Components Analysis with Varimax Rotation

Scale Items	Factor 1 (organizational skills)	Factor 2 (technical skills)
Communication	0.51	—
People management	0.46	0.32
Work in teams	0.70	—
Project management	0.75	—
Working with end users	0.56	—
Customer service	0.66	—
Respond timely to end users	0.65	0.31
General management skills	0.66	—
Windows	—	0.48
UNIX	—	0.59
C++	—	0.75
Visual Basic	—	0.69
Java	—	0.85
HTML	—	0.41
Perl	—	0.83
Network protocols	—	0.58
General technical skills	0.34	0.56
Variance explained by factor	26%	34%

Note: "—" indicates loading less than 0.30

survey questions could be answered by either checking a "radio button" or choosing one or more items from drop-down menus. Respondents were assured that all data collected from the questionnaire would be treated confidentially. Once respondents had completed the survey, they clicked a "submit" button and were transferred to a page thanking them for their cooperation. Once submitted, the data were automatically forwarded to the researchers.

Respondents were given the option of sending questions or comments about the survey to the researchers. Two comments and three requests were received, all of which were answered. The two comments concerned Web page formatting, and the three requests were for more information on the research project.

E-mail messages describing the study and providing a link to the survey site were sent to 1,000 Webmasters chosen at random from 3 Internet commercial directories. Yahoo!, the largest Internet directory with over 600,000 commercial listings, was used to choose 600 Webmasters, and 200 Webmasters were chosen at random, each from Hotbot and Snap.com, 2 other large Internet directories. The messages were sent in batches over a period of three weeks to give the researcher an opportunity to fix any technical problems that might have occurred and to avoid undue congestion on the survey site Web server.

Of the 1,000 messages sent out, 188 did not reach the intended recipients. The remaining 812 messages failed to "bounce" back to the researcher and were thus assumed to reach the target. Of these, 232 usable surveys were returned. This repre-

sents a response rate of just over 28 percent. Schaefer and Dillman considered anything over 20 percent a good response rate for an e-mail survey design [47]. In an exploration of response rates for e-mail surveys, Sheehan and McMillan considered a response rate of 24 percent as adequate [50].

Eighty percent of responses were received within twenty-four hours of the respondent being contacted. A further 15 percent were received during the following 24 hours. Only one percent of responses were received more than one month after initial contact by e-mail had been made. Reminder e-mail messages were sent to known nonrespondents two weeks following the first contact. Only a small increase in usable responses accrued from this second contact.

In order to check for nonresponse bias, the last 20 percent of responses were compared on a number of dimensions to the first 20 percent of responses [4]. No significant differences in the two groups were found, thus strengthening the argument against nonresponse bias. The fact that the demographic data was extremely varied also argues that the respondent sample was unbiased to particular size or group demographics.

Table 5 describes the participating organizations and survey respondents. The typical Webmaster, according to the survey, is a 36-year-old male with a bachelor's degree, earning just under $50,000. He belongs to a small organization, which first established a Web presence in 1995. As well as providing technical services, he plays a central role in determining his organization's Web strategy.

Results

TO TEST THE RESEARCH HYPOTHESES, PLS analysis was used. Since PLS may be unfamiliar to many readers, a brief explanation of the procedure is warranted. Techniques such as PLS, and its cousin LISREL, have been described as second generation multivariate analysis techniques [20, 21, 27, 33]. These techniques are superior to traditional regression and factor analysis because the items measuring the construct (that is, the measurement model) are assessed within the context of the theoretical model [58]. In contrast, computing factor analysis scores and importing them into a regression model assumes that the scores are portable, an assumption that Fornell argues is not tenable [20]. PLS has been used in the fields of management information systems [45], marketing [5], and organizational behavior [25].

Table 6 shows the path coefficients, which are standardized regression coefficients generated from the PLS analysis. Jackknifing [22] was used to calculate the statistical significance levels for these coefficients. Jackknifing is a powerful, nonparametric technique that works by comparing the path coefficients using blocks of data over multiple iterations [52]. Jackknifing does not require the usual assumptions of normality associated with regression models.

Hypotheses 1a and 1b were both supported. Hypothesis 1a states that perceived organizational skill deficiency leads to lower job performance. As Table 6 shows, the path coefficient between perceived organizational deficiency and performance is –0.368, significant at the $p < 0.01$ level. Hypothesis 1b is also supported by the data.

Table 5. Profile of Respondents and Respondent Organizations

Variable	Value	Variable	Value
Respondent profile		**Organizational profile**	
Sex		Organization size	
Male	77%	Less than 100 employees	44%
Female	23%	101–1,000 employees	26%
Age (mean)	36	More than 1,000 employees	30%
Years in organization (mean)	4.1	Use of technology	
Years in department (mean)	3	Extensive	61%
Education		Average	33%
High school or equivalent	14%	Minimal	6%
Technical or community college	12%	First corporate Web page (median)	1995
Bachelors degree	49%		
Masters degree	25%		
Number of messages received from end users per week (mean)	112		
Salary (mean)	$49,300		
Central role in Web strategy determination			
Yes	88%		
No	12%		

Table 6. Main Results (a): Path Coefficients and Significance Levels

Hypothesis	Job Performance	Supported
H1a: Perceived organizational skill deficiency	–0.368**	Yes
H1b: Perceived organizational skill surplus	–0.312*	Yes
H2a: Perceived technical skill deficiency	–0.294*	Yes
H2b: Perceived technical skill surplus	–0.223	No
H3a: Perceived organizational skill balance	0.324*	Yes
H3b: Perceived technical skill balance	0.355*	Yes

* $p < 0.05$; ** $p < 0.01$

The path between perceived organizational skill surplus and job performance is –0.312, significant at the $p < 0.05$ level. The results show that both organizational skill *deficiencies* and *surpluses* led to lower job performance.

Hypothesis 2a states that perceived technical skill deficiency leads to lower job performance. As Table 6 shows, the path coefficient between perceived technical skill deficiency and job performance is –0.294, significant at the $p < 0.05$ level. Thus, hypothesis 2a is supported. Hypothesis 2b, however, is not supported by the data. The path between technical skills surplus and job performance was negative (–0.223), but not significant ($p = 0.23$). Thus, technical skill deficiencies (but not surpluses) lead to lower job performance.

Hypotheses 3a and 3b explored the condition when neither a skill deficiency nor a skill surplus existed. This "balance" condition occurs when the perceived proficiency in a skill is approximately equal to the perceived importance of that skill.[1] In other words, the Webmaster is perceived to have the appropriate proficiency in a skill considering the skill's importance to his position. The results show that skill balance leads to higher perceived performance in both organizational skills and technical skills. The path coefficient between a balance in organizational skills and job performance was 0.324, whereas the path coefficient between a balance in technical skills and job performance was 0.355. As both paths were significant at the $p < 0.05$ level, hypotheses 3a and 3b were both supported by the data. This result suggests that balancing the usefulness of skills and abilities with performance levels in those skills and abilities may be an important factor in job performance.

Hypothesis 4a states that perceived organizational skill deficiency is associated more strongly than perceived technical deficiency with job performance. As Table 7 shows, this was confirmed in the analysis. The path coefficient between perceived organizational deficiency and performance was –0.368, whereas the path coefficient between perceived technical deficiency and performance was –0.294. These two values were found to differ significantly from one another across the sample when subjected to a *t*-test ($t = 4.3$, $p < 0.05$). Therefore, hypothesis 4a is also supported by the data. Hypothesis 4a, which states that organizational skill surpluses associate more strongly with negative job performance than technical skill surpluses, could not be tested since the path coefficient between technical skill surplus and job performance was not significant.

Along with path coefficients, PLS analysis provides an r^2 value on the dependent variable. This figure describes the amount of variance in the dependent variable explained by variance in the independent variables. The r^2 value was computed for overall skill deficiencies ($r^2 = 0.23$), and for overall skill surpluses ($r^2 = 0.12$). Therefore, together, organizational and technical skill deficiencies and surpluses accounted for 35 percent of the variance in job performance in Webmasters.

Overall, the data showed strong support for the hypotheses. The link between skill deficiencies and job performance was clearly demonstrated. This result lends empirical support to propositions 1a and 1b. The link between skill surpluses and job performance was also demonstrated, although the data was only significant for organizational skills, not technical skills. Thus, support for proposition 2 was mixed. The data strongly corroborated a link between skill balance and job performance, thus propositions 3a and 3b achieved empirical support. Regarding the relative power of organizational versus technical skills to affect job performance, the results were mixed. Organizational skill deficiencies were shown to have a larger, negative effect on job performance than technical skill deficiencies, however, no conclusion could be reached regarding the relative effect of skill surpluses on job performance. Finally, skill deficiencies and surpluses were shown to provide a reasonably strong effect on the variance in job performance among the Webmasters sampled. Implications of these findings will be discussed in the following section.

Table 7. Main Results (b): Comparison of Organizational and Technical Skills

Hypothesis	Comparison	Supported
H4a: Organizational skill deficiencies have a greater, negative effect on job performance than technical skill deficiencies	–0.368 vs. –0.294 difference significant at $p < 0.05$	Yes
H4b: Organizational skill surpluses have a greater, negative effect on job performance than technical skill surpluses	Cannot test since technical skill surplus effect on job performance not significant	No

Discussion

Implications for Research

THERE ARE THREE MAIN CONTRIBUTIONS to researchers flowing from this study. First, the job-content analysis of 800 Webmaster positions has offered a cogent description of this job's requirements. This analysis found that technical skills superseded organizational ones by a ratio of six-to-one. Two explanations are offered. First, as suggested earlier, it may be that employers wish to screen prospective applicants on the basis of their technical expertise. In this case, technical skills are necessary, but not sufficient. They may serve as a screening tool for interviews, although qualitative data gathered from interviews casts some doubt on this possibility. Second, it could be that employers believe they can either teach prospective Webmasters the necessary organizational skills, or that their organizations are structured in such a way as to make possession of organizational skills second to technical ones. This explanation supposes that the organizations' cultures are all idiosyncratic, and thus, not apt to be reflected in the organizational skills of any individual.

If this latter condition were the case, then it defies previous research [37, 62], which suggests that those organizations that are most successful with information technology are those that seamlessly integrate the IS function with the rest of the organization. Business-focused IS personnel are but one necessary ingredient to this condition.

Alternatively, it could be that the pace of technological change is such that organizations are choosing to sacrifice organizational skills for technical aptitude. A popular adage maintains that one "web-year" is comparable to seven "real" years, given the rapid pace of change in the industry and in technology. If this were the case, then webmasters need to continuously keep abreast of technical developments in order to continue contributing to their organizations—albeit at the expense of organizational skills. Future research might test these assumptions in a longitudinal setting, with actual Webmaster incumbents.

The second, and perhaps most intriguing finding of this study is the establishment of an empirical link between the importance of a skill, proficiency in that skill, and

perceived job performance. It is the combination of these factors that provides the link to performance. The results say nothing of how perceived usefulness and perceived proficiency *alone* relate to performance—only how they relate *together* through the deficiency construct. In fact, as perhaps is to be expected, a positive link was found between proficiency in both technical and organizational skills and job performance, however, that link was weak.

Other studies have looked at the link between skill deficiency and educational needs [30, 37], and at the link between skill proficiency and performance [7, 12, 19, 38], yet none have specifically linked skill deficiency and perceived performance. The present study has shown that skill deficiency can provide a relatively strong link to performance. Future researchers might choose to study whether this link holds in other situations. For example, skill deficiencies (and surpluses) could be measured over a wide variety of subjects, skills, and job classifications. Future research might extend the methodology used in the present study to look at IS personnel in other areas, such as programmers, systems analysts, and IS managers.

Third, more effort could be expended comparing the effects of skill "deficiencies" and "surpluses." It appears from the current study that both factors lead to a lower perceived performance. It seems that having "too much proficiency" in a skill is just as bad as not having enough. The reasons for this might also be investigated in future research. Future research may also be able to explore what factors explain the 65 percent in variance on perceived job performance, which was not explained by either a skill deficiency or surplus.

Finally, this study contributes to our understanding of skill sets, surpluses, and deficiencies for IS personnel with its finding that a skill balance, that is, an exact match between the individual's level of proficiency in that skill, and its usefulness to the job, leads to higher perceived performance. This stands to reason. If an individual is skilled in an area valued by their organization, then they will undoubtedly perceive themselves to be performing well. This study shows empirical support for this assertion, and shows that in the case of Webmasters, a match of both technical and organizational skills far exceeds an imbalance on either the positive or negative sides.

Implications for Managers

Electronic business (the buying and selling of goods over the Internet and the establishment of long-standing relationships with customers) is expected to grow exponentially in the next five years. Customers are growing used to interacting with organizations using Web sites, and companies are welcoming the efficiencies and scope that the Web may afford their enterprises. It follows, then, that the Webmaster is a key player in enacting an organization's Web strategy. This research suggests that a contradiction exists between what employers see to be the role of the Webmaster and what Webmasters themselves see their roles to be. It seems possible that employers are hiring Webmasters who are technically qualified, but organizationally unqualified for the positions they take up. What is more, the skill deficiency that results from this disparity affects a Webmaster's perceived job performance. It is clear, then, that man-

agers must closely evaluate the role that Webmasters will play in their organizations, and hire accordingly. This research suggests that organizational skills ought to be more prominent in the minds of recruiters.

This research also suggests that a skills balance is desirable if performance is to be perceived as positive and high. Balance, in part, relies on the individual's ability, but it also depends on the perceived usefulness of that skill in organizations. Roepke et al. [46] examined the transformation of IT from a back-office support role to a strategic business role, and the accompanying requirement for new competencies for IT personnel. A key skill identified in the study was the ability to cooperate with other areas of the firm. This is an ability that was found to be deficient in many IT personnel [16, 32]. The Webmaster's position is one that transcends internal functional boundaries. In establishing a firm's Web site, for example, the Webmaster must be cognizant of, and respond to the demands of, the marketing group (responsible for finding and attracting customers), the sales arm of the organization, logistics (who will fill orders), and finance (who will report on revenues and expenses), to name but a few areas affected. As such, the Webmaster must possess a set of skills that closely matches the needs of the organization in this regard. Recruiting primarily on the basis of technical skills is inefficient. This research suggests that organizations and recruiters need to strike a balance between organizational and technical skills in their job postings, and amend their advertisements accordingly.

Finally, the results of the study suggest that managers should be aware of the need for an ongoing balance between importance and proficiency of both technical and organizational skills. If it is determined that one or another are lacking, steps should be taken to create or reinstate a balance. For example, internal promotional campaigns or incentive schemes may be used to influence the importance of a skill. Training programs, especially in organizational, management and behavioral areas, could be used to increase organizational skills. Outside courses could be used to allow Webmasters to upgrade their technical expertise, as could attendance at industry and vendor seminars. This research suggests that the rapid pace of change characterizing the internet implies an ongoing investment in the development of IS personnel in general, and of Webmasters in particular.

Limitations

There are several limitations to the current study. In the first place, although its use can be defended in the current context, the online approach to data collection is unproven. Concerns over reliability and validity of the approach, particularly over coverage bias, have been noted. In order to address this limitation, future research might be done by more traditional means such as through structured interviews or mail surveys.

In order to gain a fuller understanding of the Webmaster role, further data collection might be undertaken to augment the results of the job-content analysis. These efforts might include interviewing or surveying employers, incumbents, or recruiters directly about their skills and about actual, not perceived job performance.

In summary, the study identifies a strong link between technical and organizational skills and perceived job performance for Webmasters. Whereas previous studies have looked at the link between skill proficiency and performance, the current study explores a more complex relationship between proficiency in a skill, importance of that skill, and job performance. Skill deficiencies and surpluses are both shown to negatively affect job performance, whereas a skill "balance" is shown to improve perceived job performance. The study also identifies a possible rift between what employers expect Webmasters to do and what they actually do leading to the possibility that many Webmasters are not optimally qualified for the positions they take up. By considering this "balance" of skills paramount, and by amending job postings accordingly, organizations may go a long way toward avoiding staffing mistakes, as could individual Webmasters.

NOTE

1. For measurement purposes, the usefulness and proficiency measures were considered in balance if they were within one scale measure of one another. All items were measured on a seven-point Likert-type scale.

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Appendix 1

Survey Instrument

THE SURVEY USED IN THIS STUDY was placed on a password protected Web page. The first 18 questions were used to determine the respondents' perceived proficiency and usefulness of various technical and organizational skills and abilities. *Usefulness* was measured on a seven-point Likert-type scale anchored at each end with "of no use" and "of absolute necessity." *Proficiency* was also measured on a seven-point Likert-type scale anchored at each end with "extremely low" and "extremely high." Respondents were also given the option of replying with "N/A" on each question.

Questions 19 and 20 were left open for respondents to input additional skills and abilities that they felt were missing from the main question set. Six unique, additional items were added by respondents.

Question 21 asked how successful the Webmaster had been in his job. A seven-point Likert-type scale was used anchored at each end with "not successful" and "very successful." Question 22 asked about the extent of the respondent's contribution to his organization's goals for the Web. Another seven-point Likert-type scale was used anchored on each end with "small extent" and "great extent."

Questions 23 to 38 were demographic questions about the respondent and the respondent's organization.

The following is a reproduction of the survey instrument:

Thank you for participating . . .

We are interested in learning more about the types of skills and abilities.
Webmasters need to be effective in their positions.

Remember: all information submitted is confidential.

This section of the questionnaire lists a series of skills and abilities. We would like your opinion as to the *usefulness* of each ability and your level of *proficiency* with respect to that ability.

1. The ability to communicate effectively with others
2. The ability to recognize and manage personality problems that interfere with job completion
3. The ability to work effectively in groups
4. The ability to manage projects
5. The ability to work with end users
6. The ability to respond to common end user problems
7. The ability to respond in a timely manner to end users
8. Familiarity with a Windows environment
9. Familiarity with a UNIX environment

10. Familiarity with a Mac environment
11. The ability to program in C++
12. The ability to program in Visual Basic
13. The ability to program in Java
14. The ability to program in HTML
15. The ability to program in Perl
16. Familiarity with network protocols
17. Having good management skills
18. Having good technical skills
19. Other
20. Other
21. How successful have you been in your position as Webmaster?
22. To what extent do you feel that your work has contributed to your company's strategic goals for the Web?

The following set of questions concern your department and your organization:

23. How many people work in your department?

    1 2–5 6–10 11–25 26–100 >100 N/A

24. How many people work in your organization?

    1 2–5 6–10 11–25 26–100 101–500

    501–1,000 1,001–50,000 >50,000 N/A

25. How would you describe your firm's use of information technology?

    Extensive Average Minimal N/A

26. What industry category does your company belong to?

    Service industry Product industry Both products and services Other

27. Where are you located?

    North America Western Europe Eastern Europe South or Central America Asia The Middle East Africa Australasia Other

28. What year did your company first establish a Web presence?

    Before 1993 1993 1994 1995 1996 1997 1998 1999 N/A

Please answer the following questions about yourself (these questions are for statistical purposes only):

29. What is your gender?

    Male Female

30. What is your year of birth?

Before 1920 1920–1930 1931–1940 1941–1950 1951–1960

1961–1970 1971–1980 1981 or after N/A

31. Are you an Employee or a Consultant/Independent contractor?

Employee Consultant Independent contractor Other

32. How many people report to you directly?

0 1 2–5 6–10 11–25 26–100 >100 N/A

33. Approximately how many messages do you receive per week from users of the company Web site?

less than 10 11–25 26–50 51–100 101–500 >500 N/A

34. How many years you have worked in your current department?

less than 1 1–2 3–5 6–10 more than 10 N/A

35. How many years you have worked in this organization?

less than 1 1–2 3–5 6–10 more than 10 N/A

36. What is the highest level of education that you have completed?

High School Graduate Technical or Community College

Bachelor's degree or equivalent Master's degree or equivalent

Doctoral degree N/A

37. Approximately what is your current salary?

less than $30,000 $30,001–$40,000 $40,001–$50,000

$50,001–$60,000 $60,001–$70,000 $70,001–$80,000

$80,001–$90,000 $90,001–$100,000 more than $100,000 N/A

38. Do you play a central role in determining your company's Web strategy?

Yes No N/A