SKILLS IN AN ENVIRONMENT OF TURBULENCE:

A SURVEY OF INFORMATION SYSTEMS PROFESSIONALS IN NEW ZEALAND

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ABSTRACT

Based on a survey of 443 members of the New Zealand Computer Society, this study examines whether the skills requirements for information systems professionals have changed in the turbulent economic environment New Zealand has experienced during the last decade. Respondents to the questionnaire were asked to rate the importance of thirty-five skill items during the period they have been working under their present job designation. Although this exploratory study is not restricted to the last decade, the research expectations are that there has been a definite shift in the skills requirement. The focus is on the categorization of the skills as business-related or technology-related, this being the distinction traditionally accepted by most researchers to date. The results, however, of this study indicate a blurring of such a dichotomy, due possibly to a perception by the more experienced members of the profession that there has been a pronounced swing towards a requirement for more business-related skills. This research suggests a model to cater for this phenomenon, and a more comprehensive set of skill items for further research.

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INTRODUCTION

Since the mid-1980s New Zealand has undergone a revolution in economic terms, moving from a traditional social welfare mentality to one of global competitiveness. In the interests of reducing public debt the government has put in place policies that have halved interest rates, but conversely have increased unemployment to over 10%. As part of the restructuring many layers of managerial staff have been made redundant, putting pressure on organisations to upgrade their management education and skills. For similar reasons, the information systems (IS) profession have not escaped the same pressure for more organisational and managerial skills.

As a by-product of the reorganisation taking place, organizations have been downsizing their IS human resources. Many IS staff are now self-employed consultants, often on contract back to the organizations that used to pay their salaries. As evidenced in recent publicity, the Inland Revenue Department is claiming that such workers should be regarded as salaried for tax purposes (Wallis, 1993).

Such profound change makes research into the skills requirement of IS personnel all the more valuable to practitioners and educators alike. The research objective is to gain an overview of the current trends in the workplace. As with previous US research the opinions of the more senior members of the profession are valuable, but instead of just asking IS managers to assess skills on the "technical ladder", this study aims to include self-assessment by personnel throughout the IS profession, managers and consultants included. Such an approach will lead to further, more focused, research based on directions suggested by the findings.

It might seem almost anachronistic to revisit the dual-ladder metaphor (Kraft, 1977, p. 63) in the context of IS careers in the 1990s, but there is evidence that the concept is enjoying a resurgence (see Moravec, 1993, for its implementation in the energy industry). Furthermore this dichotomy between organizational and technological skills

still underpins much of the research conducted in the area of the skills requirements for IS personnel (Crepeau et al., 1992).

The two promotional ladders, one for the technically-oriented personnel, and the other for the business-oriented, run in parallel with rungs to suit career advancement. So, on the technical ladder analysts are ex-programmers (Jackson, 1983, p. 56), and programmers have usually progressed from a trainee programmer position. In theory there should be enough rungs to provide progression for senior specialists. In practice, however, the business ladder usually attracts higher salaries, and the technical ladder has to cater for a variety of differing aspirations. In the first case, a senior analyst may need to jump across to the business ladder for a higher salary. In the second case, senior programmers do not necessarily want to switch to specialising in systems analysis. On what rung do we place newer positions such as that of systems administrator or help desk supervisor?

Nevertheless, the basic dichotomy between business-related and technology-related skills is still perceived as very real by employers (Hudson, 1992, pp. 112, 154, 157, 158, 178, 187). In this Australian "Hudson Report" there is ample recognition that employers are demanding that IS professionals demonstrate more knowledge of the application or business functional area. Behavioral skills such as verbal and written presentation skills seem to be in demand not only for college graduates entering the profession but also for those hoping to progress up the promotional ladder.

It seems that while employers might view job advancement in terms of different promotional ladders, the preference is for employees with skills that feature to varying degrees on both ladders.

Based on this duality, the purpose of this article is to provide information on the current perceptions of practitioners regarding the skills required in the IS profession. Although the intention is not to require the respondents to predict future trends, it is suggested that educators and employers will find current trends of value for the immediate future.

The paper proceeds as follows. First, we review the literature for research that has focused on knowledge and skills requirement for IS personnel. Based on this review, we propose a model to better explain the combination of skills, and posit research questions to be explored. Next, we explain our research study, followed by an analysis of our findings. Finally, we present a discussion of the results and implications for the IS profession and for IS educators.

PRIOR IS JOB SKILLS RESEARCH

As the only research analyzing New Zealand computing personnel is now out of date (Boswell and Melhuish, 1978), the authors turned to international sources.

The dual-ladder metaphor in relation to job skills in IS is supported in the literature by studies that have elicited the perceptions of IS managers. Based on the much earlier work of University of Minnesota researchers who reduced the 97 skills mentioned in the 1972 ACM Curriculum Recommendations to two categories, Benbasat, Dexter and Mantha (1980) categorized skills as being either general/managerial or specialist/technical. The general/managerial skills are skills related to organizations, people and society. They hypothesized that managers in the more mature IS organizations would perceive a greater usefulness for generalist skills than managers in less mature organizations. Skills related to systems, computers and models are considered to be specialist/technical ones. In a longitudinal study over a decade Cheney and colleagues (1980, 1990) noted that senior IS managers believe that managerial knowledge, skills and abilities, have increased in importance for all IS workers, particularly project managers, and will continue to do so. Their studies also conclude that several of the technically-oriented skill areas are declining in importance. The findings of Leitheiser (1992) confirm most prior research: "that academic institutions should focus on developing interpersonal and business skills, as well as technical skills. Writing, speaking, persuading, working with others, and understanding others' emotions are all important.." (p. 86).

The same duality arises in terms of the personality of IS specialists in comparison with so-called "users". Cougar and Zawacki determined that IS personnel characteristically have a high need for self actualisation coupled with a low need for social interaction (Couger and Zawacki, 1978). This proclivity towards an avoidance of verbal communication can be interpreted as a personality style that can lead to difficulties with users, seen typically as belonging to the diametrically opposite applications arena where a more extroverted style is the norm. As a corollary to this position Couger and Zawacki (1980) also suggested that such IS personnel should then be managed differently from non-IS personnel.

Universities and educational institutions face a similar dilemma. According to Zawacki (1988) it appears that the early technical course content reinforces those job expectations for prospective IS professionals. When many of those students in advanced IS courses must socialize in teams and interact with potential users, they may question

their career selection. On the other hand, students with higher social needs often select majors in personnel management, marketing, or production management. Consequently he suggests more entry-level courses on group dynamics, human behavior, negotiation skills, change skills, and conflict resolution. Similarly, researchers Watson, Young, Miranda, Robichaux and Seerley (1990) conclude in their study of skills for new hires: "No longer restricted to "techies", MIS positions are demanding business knowledge, communications, and interpersonal skills...The demand is now shifting towards hiring employees with the ability to communicate as well as to perform technical tasks" (p. 26).

To summarize, the dual-ladder metaphor, in practice applied to job advancement, seems perhaps implicitly, to have been adopted by most researchers as a framework to examine the skills requirement for IS personnel. The consistent finding is the demand for more of the skills found on the business or organizational ladder. It must be pointed out, however, that most research has focused on the technical ladder.

RESEARCH EXPECTATIONS

The principal objective of this study is to examine whether the skills requirements for information systems professionals has been changing, especially in the turbulent and inexorably changing economic environment experienced in New Zealand during the last decade. The expectation is, given the very consistent evidence from international research concerning increasing emphasis on business-related skills, coupled with the more competitive economic environment, that results will tend to confirm this trend.

THE STUDY

The review of the literature provided a sound platform for researching the skills requirement of the New Zealand IS professional. As New Zealand academic institutions base their IS curricula on the ACM recommendations, this study's questionnaire arises out of the Knowledge, Skills and Abilities (KSA), defined by Cheney et al. (1990 p. 238) as:

> *Knowledge* refers to the content or technical information needed to perform adequately in a job and is normally obtained through formal education, on-the-job training, and information media, such as manuals. *Skills* are the specific psychomotor processes necessary to meet the current requirements of a specific job... *Abilities* refer to the cognitive factors that represent present capabilities or achievement levels. (p. 238)

But as their 20 KSAs depended upon 1970s ACM recommendations, we added a further 4 items to take into account influences such as end-user computing, PCs, CASE and 4GLs, project management and the literature's emphasis on the need for business-related skills. A pilot group of IS practitioners enroled extramurally at our university were asked to comment on the wording and selection of the 24 KSAs. Further refinements ensued, and 11 more KSAs were added, resulting in a total of 35 as in Table 4.

In keeping with the research expectations, the survey instrument selected is a retrospective panel sample. The retrospective nature of the questionnaire relates to the use of two 7-point Likert scales for each KSA item. For each scale, one represents a low importance rating for the item and seven represents a high importance (see Figure 1).

The first Likert scale is used by the respondents to rate the importance of the skill at the time they first entered a position with their current job designation. The second scale is for their assessment of the skill at present in their job.

With the addition of 15 KSAs, and after a review of the literature, it became necessary to re-assess the appropriateness of the dual-ladder metaphor.

A MODEL FOR ANALYSIS OF JOB SKILLS

The nature of the dual-ladder in a technically-oriented profession such as IS means the technology ladder has been reserved for systems analysts/designers and programmers. Traditionally for a senior analyst/designer on the top rung promotion has often meant having to jump across to a management rung on the business ladder. The management rung could be that of IS manager, manager of IS development, Information Center manager or project manager, positions that require a more diverse set of skills primarily due to the cross-functional nature of IS (Perry, 1991, p. 12). Perry details the technically-oriented challenges of the modern IS manager as: changing technology, when to abort a project, executive management ignorance of MIS, user ignorance of MIS, audit requirements, use of consultants, ability to keep current technically, complexity of systems, new system development standards, how to evaluate MIS products, professionalism (pp. 11-16).

	When you first started	At the present time
1. Project Management	1 ____2 ____3 ____4 ____5 ____6 ____7	1 ____2 ____3 ____4 ____5 ____6 ____7

Figure 1: An example of the Questionnaire Likert Scales

As can be seen from this list of issues, the dual categories of specialist/technical and general/managerial that most researchers have adopted for analyzing the technical ladder (Benbasat, Dexter and Mantha, 1980; Leitheiser, 1992; Jones and Arnett, 1993), is inappropriate for researching managerial positions in IS. An IS manager should be prepared to take a broad, less detailed view of the technology, while concentrating more on the process of managing. Consequently this paper is proposing a Skills Matrix with two further categories for researchers who are analyzing all IS positions and not just the technical ladder. The addition of general/technical and specialist/managerial skill categories not only caters for the managerial ladder but also accommodates a diverse range of new positions that have arisen due to end-user pressure or technological developments. The model is a 2 X 2 matrix, with the dual-ladders incorporating both general and specialist dimensions(see Figure 2).

	Managerial	**Technical**
General	Verbal People Written comms. Negotiating Gen. mgmt Health & safety	S/W evaluation Security&DRP DSS Project evaluation User training & support Documentation Control/auditing Prototyping PCs Info gathering
Specialist	SISP Project Mgmt Marketing Legal Abreast of New Tech Quality Stats Business Knowledge	Systems Analysis 4GL 3GL DBMS OS minis mainframe Operations CASE H/W evaluation Telecomms.

Figure 2: IS Skills Matrix

To aid analysis of the survey results we have assigned the 35 KSAs on an *a priori* basis to the quadrant that seemed the most appropriate.

SURVEY RESPONSE

The only national professional body that represents IS personnel is the New Zealand Computer Society (NZCS) with a membership of approximately 1800, which it estimates as representing approximately 10% of the IS profession. The Society demonstrated its support of this research by administering the mail-out. As this survey is targeting practitioners resident in New Zealand, 1455 members remained after academics, teachers, members overseas, retired members and students were removed from the list.

The questionnaires were mailed out in mid-June, 1993 with postage paid envelopes and a personalised covering letter. 470 were returned of which 27 had to be rejected, resulting in a 30% success rate.

The demographics of the 443 respondents to the questionnaire, as in Tables 1 and 2, are in keeping with the expectation for a more senior and managerial stratification. The low percentage in the traditional systems analyst/programmer job categories is most likely explained by the re-classification of personnel as consultants engaged in "business analysis" (as predicted in Australia: Hudson, 1992, p. 75)

Worthy of note is the low percentage of female respondents: only 12.9% (57).

New Zealand is well-known for its low participation rate in terms of tertiary education. In this survey 27.5% (122) of respondents do not hold any tertiary qualification, while 45.4% have a bachelor's degree, 12.4% a master's, and 2.7% have a PhD.

The average age for the sample is 41, with 13.8% aged 30 years or younger. While 12.9% have no management experience, 49.2% have between 2 to 10 years experience. The average number of years "in the computer field" is 16.3 compared with the average of 7.3 years in the current job code (Table 2).

Table 1: Respondents by Job Designation

Job Designation	Number of Respondents	Percent
Director/Executive	82	18.5
Middle Management	89	20.1
First Line Supervisor and Project Manager	44	9.9
Consultant	121	27.3
DP Trainer	6	1.4
Systems Analyst	19	4.3
Programmer/Analyst or Analyst/Programmer	52	11.7
Programmer	6	1.4
Systems Programmer	10	2.3
Data Base Designer	5	1.1
Data Communications Specialist	4	0.9
Computer Operator	2	0.5
Operations Scheduler	1	0.2
Systems Administrator	2	0.5
Total	**443**	

Table 2: Respondents by years in their current job designation

Number of Years in Current Job Designation	Number of Respondents
1 to 2	57
3 to 5	143
6 to 10	154
11 to 30	89
Total	**443**

Most research samples in the literature are relatively small, attracting fewer than 100 respondents (Benbasat et al., 1980; Cheney et al., 1990; Leitheiser, 1992; Watson et al, 1990). This larger sample includes a strong representation on the managerial ladder, and instead of being asked to comment on their employees on the technical ladder the respondents are asked to rate the importance of both managerial and technical skills in their own jobs.

DATA ANALYSIS

The findings are presented in two sections. In the first section, the overall data will be discussed. The second section contains further analysis concentrating on experience levels and distinctions between job categories. Both sections address the principal research question: has there been a discernible shift in the skills requirements?

The Overall Data

Based on the respondents' Likert scale ratings for each of the thirty-five KSAs, *t*-tests were calculated on the pooled sample variance, comparing ratings on both Likert scales. Respondents were required to use the first scale to rate the importance of the KSA in their job when they first entered their current job designation (even though it may include re-employment in different organizations). The second scale was used to indicate the importance of the KSA at the present time in the job. Hence over the total sample

each time difference between the two scales varies according to an individual's career - anything from one to thirty years. The means and significant *t*-values by KSA, are shown in Table 4. A significant positive *t*-value suggests that the KSA has increased in importance over time for the whole sample. Conversely, a significant negative *t*-value tends to indicate that the KSA has decreased in importance.

In order to avoid a Type 1 error a statistical significance alpha level of 0.01 was applied. On this basis we have regarded the comparative importance over time of *Operating Systems, Systems Analysis & Design Technique* (perhaps compensated for by a significant increase in the importance of *Information gathering techniques*?), and *Mini-computers* as not significant.

The following analysis of results relates in general terms to the proposed Skills Matrix (Figure 2).

Table 4: Mean Scores and Significant Changes in the Value of KSAs

Knowledge, skill of ability	Start	Now	t-value
People skills	**4.78**	**6.03**	**17.30** *
Verbal & presentation skills	**4.64**	**5.92**	**18.19** *
Written communication skills	**4.86**	**5.88**	15.85 *
Keeping abreast with new technology	**4.74**	**5.73**	13.54 *
Knowledge of the business area	**4.51**	**5.60**	14.88 *
Information gathering techniques	**4.74**	**5.47**	10.00 *
Personal computer systems	3.08	**5.45**	**24.04** *
Project management skills	**4.01**	**5.43**	16.69 *
General management skills	**3.91**	**5.36**	**18.81** *
Negotiating skills	3.56	**5.19**	**21.31** *
Project evaluation & justification	3.61	**5.09**	**19.54** *
Quality management concepts	2.82	4.99	**27.63** *
Telecomms & networking concepts	2.93	4.81	**21.61** *
Computer security & disaster recovery	3.37	4.73	16.11 *
Use & evaluation of software packages	3.54	4.71	13.35 *
Marketing skills	3.00	4.70	**19.81** *
User training & support	**3.94**	4.62	7.75 *
Strategic Info. Systems Planning	2.76	4.61	**20.32** *
Documentation writing skills	**3.92**	4.60	9.01 *
Systems Analysis & Design techniques	**4.29**	4.48	1.98 **
Computer controls & auditing	3.33	4.34	13.37 *
Understanding legal issues	2.75	4.28	**20.29** *
Use & evaluation of hardware	3.52	4.10	6.95 *
DBMS & database design	3.10	3.95	8.79 *
Operating Systems	3.57	3.71	1.83
Prototyping techniques	2.64	3.66	13.16 *
Mini-computer systems	3.35	3.54	2.19 **
4th generation (4GL) programming	2.64	3.53	8.59 *
Decision support systems	2.35	3.44	15.24 *
Health & safety	2.73	3.41	11.77 *
CASE techniques	2.06	3.29	14.58 *
Computer Operations, JCL, data capture	3.26	2.72	-6.35 *
3rd generation (3GL) programming	3.50	2.71	-9.09 *
Statistical & simulation techniques	2.29	2.69	6.25 *
Mainframe systems	3.46	2.54	-10.45 *

* alpha = 0.01; ** alpha = 0.05. The eleven highest means or most significant *t*-values are in **bold**.

Those skills regarded as substantially less important are *3GL programming*, knowledge of *Mainframe systems*, and *Computer Operations, JCL, data capture* (one younger respondent queried the mnemonic!). These three items are the only with negative *t*-values, and they all fall into the specialist/technology domain. On the other hand, and it should be of no surprise, knowledge of *Telecomms & networking concepts* and familiarity with *Personal computer systems* feature as much more important requirements today. Also in the top group of KSAs to have become most important are *Strategic Information Systems Planning* and *Project evaluation & justification*, both of which could be classed as specialist/managerial. The popularity of these two can possibly be explained by the high proportion of consultants who would be advising clients in these areas. For similar reasons *Project management skills* has assumed greater prominence.

In the generalist/managerial domain, a KSA that is perceived to have gained significantly in importance is that of *General management skills*, reinforced by *Verbal & presentation skills*, *People skills* and *Negotiating skills*. The remainder in the top group of increased importance over time can be classified as specialist/managerial: *Understanding legal issues*, *Marketing skills*, *Quality management concepts*.

The next group of KSAs are in the area of software development tools and techniques. The perception about development tools seems to be that *DBMS & database design* and *4GL programming* have been increasing in importance at a much slower rate than their more automated successors: *Prototyping* and *CASE techniques*. Similarly, as New Zealanders are noted for their experimentation, *Keeping abreast with new technology* rates as significant as the latter.

Increasing awareness of the importance of *Computer security & disaster recovery* and *Computer controls & auditing* is confirmed by these results.

Statistical & simulation techniques features as much lower in increasing importance than *Decision support systems*, even though DSS relies heavily on business statistics. This result confirms the wary attitude of many practitioners to the application of statistics to explain organizational phenomena. This emphasis on the need to apply technology to an organization issue is reflected in the increasing importance placed on *Knowledge of the business area* and *Use & evaluation of software packages*. By contrast, *Use & evaluation of hardware* is seen as increasing at a much slower rate of importance, at approximately the same level as *User training & support*. With reference to the latter, the result seems to confirm the tendency of many organizations to slash training budgets in times of retrenchment. Finally, the increasing maturity of the IS profession is reflected in the relative importance given to *Documentation writing skills* as an essential part of systems development and maintenance.

To sum up, the evidence is that greater importance is being placed on skills in both specialist and generalist management areas, with a definite decrease in importance in the specialist/technical, apart from telecommunications and, perhaps CASE. In a shift towards the more generalist/technology skills, knowledge of personal computers and prototyping is supported.

Inter-group comparisons by Job Category and Experience Level

Longitudinal research samples in the literature have been small and have looked at broad trends over approximately 10 years (Cheney et al., 1990). As our sample is comparatively large and covers a period of up to 30 years, we have taken extended the research by exploring the influences of experience levels and job categories.

For this analysis the same 35 KSAs are still the items of interest in terms of the importance placed on particular skills over the period of the respondents' employment. First of all, for each response the difference between the "At the present time" and the "When you first started" scores (Figure 1) was calculated.

Then two separate analyses were conducted, based on the data being split two different ways. For the first analysis, the sample was divided into three groups (as in Table 2) depending on years of experience in the current job category (ie not necessarily for their whole career in IS). Arbitrarily we decided to pass over those with less than three years' experience, on the grounds that either the timespan does not allow for sufficient discrimination in the minds of the respondents or because they could be regarded as "inexperienced". The three time periods selected are 3 to 5, 6 to 10, and 11 to 30 years. For the second analysis, the data was split into four broad categories of job description (refer to Table 1): executive management, middle management (which includes line and project management), consultants, and "Programmers Analysts etc." (which in Table 1 represents all the others on the technical ladder).

The unit of analysis is still the KSA whose importance has been rated by respondents. For each group a mean difference score was calculated. Then the Scheffé test, which is regarded as conservative, was used to determine

statistical significance, at an alpha level of 0.05, of the difference between the mean scores.

In the first analysis, we highlighted any differences in the importance of KSAs in each job category depending upon the various levels of experience. In the second, we analysed any differences in the importance of KSAs in each level of experience depending upon the various job categories.

In the first inter-group comparison (Table 5) knowledge of *Personal computer systems* appears as significant in all job categories. On reflection, it is of little surprise that the least experienced in all job categories rate the degree of change in this requirement as of much less importance than their most experienced counterparts. It is probable that the former accept the world of PCs, while the latter have grown through most of the micro-computer revolution of the 1980s. A similar picture emerges for middle management in terms of *Use & evaluation of software packages* - the difference between least and most experienced is statistically significant. If we accept its relative importance from the prior *t*-tests in comparison with *Use & evaluation of hardware*, it could be that the most experienced have lived through the disillusionment of high software development overruns and too much fascination with hardware.

Table 5: Differences in Perceived Importance of KSA:
Mean difference scores, Job Category within Years of Experience

Knowledge, skill or ability	Years of Experience 1 (3-5)	2 (6-10)	3 (11-30)	F	p	Scheffé Difference
I. Executive Management						
Personal computer systems	1.59	2.52	3.27	3.96	0.0234	1 versus 3
II. Middle Management						
Personal computer systems	1.76	2.97	3.70	10.08	0.0001	1 versus 2 1 versus 3
Use & evaluation of software packages	0.61	1.39	1.74	3.79	0.0256	1 versus 3
III. Consultants						
3rd generation programming	-1.00	-0.33	-2.05	5.16	0.0074	3 versus 2
CASE techniques	0.74	1.87	2.28	5.19	0.0072	1 versus 2 1 versus 3
Personal computer systems	1.67	2.91	3.67	9.61	0.0002	1 versus 2 1 versus 3
IV. Analyst, Programmers etc.						
4th generation programming	0.78	1.70	3.45	9.97	0.0001	1 versus 3 2 versus 3
CASE techniques	0.48	1.13	2.32	7.03	0.0015	1 versus 3 2 versus 3
Computer Operations, JCL, data capture	1.09	-0.16	-1.18	10.40	0.0001	3 versus 1 2 versus 1
DBMS & database design	1.27	1.19	2.77	4.89	0.0099	2 versus 3
Mainframe systems	0.39	-0.73	-1.76	7.86	0.0007	3 versus 1
Personal computer systems	1.58	2.73	3.55	5.34	0.0065	1 versus 3
Prototyping techniques	1.21	1.07	2.18	4.20	0.0181	2 versus 3

The issue of software development languages and tools appear as significant in the categories of consultant and the fourth, more technically-oriented group. The most experienced consultants are distinctly more positive about the decreasing importance of 3GLs than the 6 to 10 year group. Conversely, both these groups have witnessed more change in the importance of CASE tools than the least experienced consultants. In a similar vein, the most experienced in the Programmers/Analysts group attest to more importance to both CASE and 4GLs over time than either of the lesser experienced cohorts, while in the case of both *DBMS & database design* and *Prototyping techniques* they are significantly more positive about the two KSAs' importance than the middle group. The same most experienced group have seen more of a declining importance of *Mainframe systems* and *Computer Operations, JCL, data capture* in comparison with the least experienced.

To summarize, an inter-group comparison on level of experience shows that the longer IS personnel have worked in a particular job category the more they detect significant shifts in skill requirements. There is a perceived swing away from the specialist/technical skills (such as 3GL, mainframe systems and computer operations) towards the generalist/technical (PCs, 4GL, database and prototyping). The least experienced are less polarised on issues. These trends apply across all job categories.

Table 6: Differences in Perceived Importance of KSA:
Mean difference scores, Years of Experience within Job Category

Knowledge, skill or ability	Job Category 1 Exec Mgmt	2 Middle Mgmt	3 Consul-tants	4 Progs Analyst etc.	F	p	Scheffé Difference
I. 3 - 5 Years Experience							
Computer controls & auditing	0.08	1.20	0.74	1.63	5.99	0.0007	1 versus 2
							1 versus 4
Computer Operations, JCL, data capture	-0.67	-0.50	-0.36	1.09	7.57	0.0001	1 versus 4
							2 versus 4
							3 versus 4
Computer security & disaster recovery	0.44	1.49	1.49	1.92	3.99	0.0092	1 versus 4
Documentation writing skills	0.07	0.88	0.69	1.50	3.39	0.0201	1 versus 4
Keeping abreast with new technology	0.41	1.12	0.95	2.00	4.53	0.0047	1 versus 4
Mainframe systems	-0.96	-0.76	-0.77	0.39	3.66	0.0142	1 versus 4
							2 versus 4
Operating Systems	-0.63	-0.23	-0.06	1.33	7.56	0.0001	1 versus 4
							3 versus 4
							2 versus 4
Project management skills	0.78	1.69	1.97	2.00	3.69	0.0136	1 versus 3
Systems Analysis & Design techniques	-0.30	-0.20	0.24	1.67	7.03	0.0002	1 versus 4
							2 versus 4
							3 versus 4
Use & evaluation of hardware	0.19	0.73	0.87	1.58	3.43	0.0190	1 versus 4
II. 6 - 10 Years Experience							
Documentation writing skills	0.08	0.31	0.96	1.25	3.86	0.0108	1 versus 4
Information gathering techniques	0.00	0.50	1.32	1.25	5.90	0.0008	1 versus 4
							1 versus 3
Project management skills	0.44	1.17	1.98	1.79	4.16	0.0074	1 versus 3
Quality management concepts	2.08	1.97	2.81	1.70	3.82	0.0113	4 versus 3
Strategic Info. Systems Planning	1.72	2.00	2.53	1.27	3.41	0.0193	4 versus 3
Systems Analysis & Design techniques	0.04	-0.61	0.39	0.68	3.25	0.0237	2 versus 4
Understanding legal issues	2.12	1.42	2.15	1.16	3.71	0.0130	4 versus 3
Verbal & presentation skills	0.72	1.17	1.83	1.07	3.42	0.0190	1 versus 3
III. 11 - 30 Years Experience							
4th generation programming	0.86	1.26	0.50	3.45	8.73	0.0000	3 versus 4
							1 versus 4
							2 versus 4
DBMS & database design	1.00	0.87	1.16	2.77	3.92	0.0115	2 versus 4
Project management skills	0.50	1.04	1.74	2.09	4.55	0.0054	1 versus 4
Strategic Info. Systems Planning	0.91	2.48	2.74	2.14	3.91	0.0116	1 versus 3
Systems Analysis & Design techniques	-0.41	0.32	-0.89	0.86	3.54	0.0183	3 versus 4

In the second inter-group comparison which is on job category (Table 6), it is interesting to note that, unlike the previous set of tests, significant results appear beyond the two technical quadrants of our Skills Matrix. Four skill items re-appear, namely, *Mainframe systems*, *Computer Operations, JCL, data capture*, *4th generation programming*, and *DBMS & database*. The first two relate to those in the least experienced group, with the technologists rating both skills significantly higher than do the executive management and middle management. In the case of the second skill the consultants also beg to differ. The technologists are polarised on the other two skills as well - rating 4GL skills as more important than do all

other job categories, and DBMS more so than do middle management.

But on the question of the continuing importance of *Operating Systems* the least experienced technologists are on their own; all other personnel with 3 to 5 years experience judge this KSA to be of diminishing importance.

Systems Analysis & Design techniques is significant in all experience levels, but again the technically-oriented respondents are more positive about its importance as a skill in their jobs, when compared with: the most and least experienced consultants, all but the most experienced middle management, and the least experienced executives. This result is supported by the fact that *Information gathering techniques*, seen as a skill necessary for analysts in a more general sense, has undergone no change in importance for executive management in the 6 to 10 year experience bracket, while consultants join the technologists in support of its importance.

Project management skills, too, is significant in all experience levels. In comparison with their executive management counterparts, consultants with 3 to 10 years' experience, and the most experienced technologists indicate its increasing importance.

The dichotomy between executive management and the more technically-oriented job category is further highlighted by all remaining significant results in the least experienced group. It is not surprising that *Use & evaluation of hardware* is still important to technologists, but what is interesting is the lack of importance given by executive management to *Computer security & disaster recovery*, *Documentation writing skills*, *Keeping abreast with new technology*, and *Computer controls & auditing* - all skills associated with risk management and the longer-term planning horizons. At least middle management are one with the technologists on the need for continuing emphasis on controls and auditing, a skill item that merits a place in the specialist/managerial quadrant of the Skills Matrix.

In the case of *Documentation writing skills*, the same significance in the difference of importance also applies for executive management and the technologists in the mid-range of experience.

The only skill item to appear significant in the generalist/managerial quadrant is *Verbal & presentation skills* within the group with 6 to 10 years' experience. In comparison with executive management, consultants claim its increasing importance. Perhaps the former have always rated it highly, and so see no need for change.

All remaining skill items fall into the specialist/managerial quadrant, and all feature as significantly more important to consultants over the perceived value to the technologists. *Strategic Information Systems Planning* is seen as growing in importance by all but the least experienced consultants. For consultants in the 6 to 10 years' experience group *Understanding legal issues*, and *Quality management concepts* have been increasing in importance.

To summarize, an inter-group comparison on job category shows that there is general polarization between those in the more technically-oriented IS jobs and executive management. This polarization is more pronounced the less experienced the two groups are, and tends to involve the more specialist areas of technology. The rising job category of consultant demands a range of specialist/managerial skills.

CONCLUDING REMARKS

This study has built upon the work by Cheney et al., but has extended research by exploring the effects of job category and level of experience on the perceptions of the skills required of IS practitioners. Due to the extensive managerial and consulting experience of the sample the traditional dual-ladder model is rendered inadequate. A more comprehensive Skills Matrix model (Figure 2) is proposed to accommodate future re-definition of the IS profession in terms of requisite skills and job designations.

In general terms, this study confirms the shift from technology-related to business-related skills. But it also demonstrates that more subtle changes are taking place. To remain employable in an environment as turbulent as New Zealand's or to seek advancement, instead of a dichotomous shift the specialist/technologist may have to consider between the choice of a generalist/technical or a specialist/managerial set of new skills. The implications are important both for educators and employers involved in the IS profession.

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