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CRITICAL SKILLS TO BE COMPETENT AND RELEVANT IT PERSONNEL: DO TODAY'S IT PERSONNEL POSSESS REQUISITE SKILLS?

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ABSTRACT

As business landscape changed, an organization expects information technologies (IT) to contribute significantly in its overall performance. Accordingly, IT activities and requisite skills of IT personnel become critical and pervasive. Both IT academics and practices emphasized the importance of both technology and business skills for IT personnel. However, many IT practitioners still reiterate the lack of IT personnel with the '*right'* skills set.

This research investigates the most requisite skills for today's IT personnel. It also examines dynamics of how such skills impact IT personnel's perception of their work and positions. Empirical study using cross-industry survey over 217 IT personnel at all positions indicated *4 categories* of specific skills: communication and problem-solving, personal traits, collaboration and project management, and IT facilitator and promotion. Three of these skill sets positively affect IT personnel's perceptions of their work and positions (e.g., work satisfaction).

We expect to contribute to IT research with the latest set of requisite skills for IT professionals. Our findings also expect to help IT practitioners to effectively strategize their recruitment, development and retention of IT workforce and IT education to keep the pipeline of future IT professionals with relevant skills.

Key words: IT personnel, IT professional, requisite skills, IT curriculum, quality of work life

INTRODUCTION

As landscape for business organizations changed due to fast-changing market and customers' preferences, global competitiveness, and the way organizations are structured (or re-structured resulted from economic downturn), traditional proficiency requirements, especially for the entry-level positions, have been changing [1]. Today's business professionals need to be capable of critical thinking, solving intricate business problems, and collaborating and communicating with businesses at every level within and outside their organizations. According to a recent, most top business executives believe that these skills and competencies (e.g., communications, creativity and innovation critical thinking collaboration and team building) become very important and critical [1].

The field of Information Technology (IT) is going through a similar change and formation of scenery. IT has been assuming a more significant and strategic role in an organization's overall plan [10]. That is, an IT unit

plays an important role in achieving organization's strategic goals and objectives by executing more organization-wide tasks and business-oriented activities. This requires different set of skills compared to the ones constituting traditional IT skills focusing heavily on technical knowledge and competencies [32]. For example, an IT unit should be able to ensure an organization's all IT resources properly aligned with its overall business strategy and core competencies (e.g., supporting an organization's business operations and processes, incorporating an organization's business priorities and IT needs, etc)[10]. This means that, to champion an organization's strategy, the IT unit should have thorough understanding of business operations and priorities, and accurate assessment of IT needs so that an organization's IT resources are placed in key areas and fully leveraged [7]. As a result, organizational expectation and responsibility of the IT unit changed IT personnel's job definitions and related roles [17]. IT personnel should be not only technologically savvy to carry their routines of supporting business functions' daily processes and operations seamlessly, but capable of cooperating and collaborating with end users in ways to properly incorporate their business priorities and IT needs. Hence, determining and assessing requisite skills of IT personnel at all positions have become critical to an organization's overall performance and success [32].

Even though both IT academics and practices resonate the importance of relevant and requisite skills for IT personnel for years, many IT practitioners reiterate a lack of competent IT personnel with the '*right'* skills set who are well-rounded in business and IT and make a good sense of IT in the business context. To make things worse, as baby-boomers retire and a lack of interest in IT careers is persistent, it is becoming a much greater challenge not only to recruit and develop IT personnel with right skills but retain them for a long run [36]. Why does this still prolong concern for IT practitioners? If both technology and business skills are critical, then what are the specific skills for today's IT personnel and how those skills affect IT personnel at work?

The main purpose of this research is to find the descriptive list of most requisite skills for today's IT personnel and add to a rich tradition of IS research on IT professionals' critical skills. It also aims to examine dynamics of how such skills impact IT personnel's perceptions of their work and positions (e.g., work satisfaction and intention to stay), which influence their job-related decisions [e.g., 13]. This is expected to provide IT practitioners with practical insights in how to develop currently required IT skills and retain such competent IT workforce for long-run. It is also expected to benefit current IT education to keep the pipeline of future IT professionals with relevant skills.

The next section reviews prior studies in IT academics and practitioners' journals on IT personnel's requisite skills, which leads us to synthesize skill sets critical and relevant to today's IT personnel. Then, we elaborate our research methodology and procedures to examine the set of most required skills. Lastly, we present results of data analysis, discussion of the results of data analysis, contributions, and limitations of the study.

IT PERSONNEL'S SKILLS SET

These days, IT activities encompass developing, managing and maintaining an organization's IT resources and applications to support its business functions and operations, incorporate its business priorities and needs, and enable an organization to achieve its strategic goals and objectives [10, 41]. Thus, many organizations ask their IT units to manage a fast-changing IT infrastructure and emerging technologies and deal with shifting organizational processes and business models. This leads the IT unit to continuously learn technologies as well as various characteristics of business [30, 38, 46]. The balance of the IT unit's main responsibilities tends to shift from central IT to business areas supporting the existing portfolio of IT applications and developing in-house IT applications to aligning IT with business problems and integration. Specifically, the IT unit focuses more on analyzing business problems and IT solutions, aligning IT with business goals, and integrating networks, existing and new business IT applications [32]. In so doing, an IT unit must ensure an organization's all IT resources properly aligned with its overall business strategy and core competencies. Due to such change of IT activities in utilizing IT resources, IT personnel should now be able to obtain accurate specification of clients' IT needs and business priorities and capable of cooperating and collaborating with end users in ways to properly incorporate their business priorities and IT needs [7, 32, 40].

IT academics recognize the importance of technical and business skills for IT professionals as indispensable skills [22, 44, 46]. In addition to technical skills traditionally expected of IT personnel, many scholars consider managerial, business, and interpersonal skills as mandatory for IT personnel [32] and in overall IT success [8]. Jiang et al [28] added that IT personnel's communication skill, especially writing and oral communication, as integral part of interpersonal skills is a critical success factor in the systems success. Overall, IT personnel should be multi-faceted: technologically savvy to carry their routines of supporting business functions'

daily processes and operations seamlessly as well as business savvy to communicate and interact with users and domain experts identify business priorities and strategic orientations and incorporate them in the organization's use of IT [7, 22, 32, 40]. Even though these skills seem to be consistent in core, they are constantly changing by adding different complexions over the years depending on demand on particular IT professions, prevailing IT resources for business organizations at times (hardware and/or software), IT's organizational role, etc. [7, 10, 28, 32, 34, 35, 40, 41, 46].

From the industry standpoint, many IT practitioners resonate the necessity of possessing both technical and business skills and the importance of possessing both skills in success of IT. As most of IT personnel's job evolves from working in the data center to working with the lines of business, IT personnel need to become more business-focused and put more importance in having a set of soft skills in addition to technical know-how: communication, interpersonal, listening, organization and such – for example, IT personnel should be capable of articulating an idea to non-IT personnel and explaining how some element of your IT organization impacts the business [25]. Such task requires comprehensive understanding of IT development and maintenance, old and emerging IT, as well as effective business communication skills (oral and written). It also asks IT personnel to possess skills and business functional domain knowledge to collect and analyze information for business problems and analyses as well as project collaboration and management skills [25, 35, 36].

In sum, we define requisite skills with the following categories as personal traits, communication and problem-understanding, collaboration and project management, and IT promotion and facilitation:

1. Skills related to personal traits: these skills entail inherited individual traits compatible with pervasive and interactive work of IT,
2. Skills related to communication and understanding business problems: these are skills relevant to communication though which both business and IT priorities can be communicated as well as business problems that can be properly understood by IT and problem owners,
3. Skills related to collaboration and project management: these encompass skills that help or enable IT personnel to work effectively with key business partners and to executive IT-involved projects on time within budget,
4. Skills related to IT facilitation and promotion: these are skills that make IT personnel effective in utilizing and leveraging IT resources in line with organizational strategy and promoting the use of IT in core business operations and processes.

Previous literature in social and behavior sciences suggests idiosyncratic dynamics among these categories of skills. A business professional needs to possess adequate level of communication skills and tactics to be effective in collaboration with one's partners or clients [19] and managing projects that require a variety of interactions with team members who have diverse characteristics and backgrounds [18]. Such communication skills can help one to play a role as a facilitator or promoter of key projects or IT development [26, 39]. In addition, one's personal traits, which may be innate, or subsequently taught or developed [23], play an important role in one's effectiveness in collaboration [48] and project management [21]. Such personal traits can also be one's critical asset in being a facilitator or promoter of organization-wide ventures [5].

In sum, we foresee IT personnel to possess communication and problem-understanding skills as well as interaction-related personal traits, which will help them to apply or harness their skills to be (more) effective in collaboration with their business partners/clients, managing IT projects, and facilitating/promoting strategic potential or use of IT.

Skills Set 1: Personal Traits and Characteristics

In general, IT personnel (e.g., programmers, systems analysts, database managers) have different characteristics from other members of an organization [14]. They are intellectually immersed, have a high degree of professionalism, and value job-autonomy and artistry of their accomplishments [6]. They also tend to be ambitious, self-confident, creative, opportunistic in personal growth, and cultivate relationships with internal and external referents [6, 12, 31]. In addition, IT personnel should have a range of traits (innate or subsequently developed) that make them friendly and compassionate, respecting others' opinions, beliefs and practices while standing up for their own ideas in a politically-correct manner.

All these traits will help or enable IT personnel to relate them to colleagues, strategic partners, and inside- and out-side client so that they can implement skills to be effective in collaborating with their business partners, promoting IT, selling innovative/creative ideas helping businesses with IT.

Skills Set 2: Communication with Business Partners and Understanding Business Problems

Today's IT activities become very complex and intricate with an organization's overall business and strategic plans [33] that entail a significant amount of resources (e.g., time, effort, financial resources, etc.) and extra inputs (e.g., knowledge of business priorities, processes and operations)[20]. Such activities typically encompass developing, managing and maintaining an organization's IT resources and applications to support its business functions and operations, incorporate its business priorities and needs, and enable an organization to achieve its strategic goals and objectives [10, 41].

Accordingly, IT personnel should possess skills to effectively interact with users and domain experts identify business priorities and strategic orientations and incorporate them in the organization's use of IT [7, 22, 32, 40] and a variety of organization-wide IT projects. Specifically, IT personnel should have skills that will help or enable them to communicate with their business clients and partners seamlessly about business and IT goals and priorities. IT personnel should also have skills that will make them to thoroughly investigate business problems and relate them with IT as possible solutions (e.g., treating business problems with open mind, asking questions from various angles/perspectives, redefining problems in a way that all involved business parties reach common understanding and consensus in IT solutions).

Skills Set 3: Collaboration with Business Lines and Management of Cross-functional IT Project

Current business environment (e.g., global competition, economic downturn) leads IT to focus on business goals and manage IT resources not only to support existing business processes and operations, but enable the organization to be flexible to the market and product trends and proactively seek opportunities and alliances [45]. Accordingly, most IT units are increasingly asked to collaborate with a variety of business functions to evaluate how IT relates to core businesses and determine how to adapt/adjust to changing processes and address broader business needs with IT solutions [2, 9, 25]. This trend of IT working with the business is becoming a norm across industries (e.g., IT personnel at the consumer goods firm closely working with marketing to improve analytics and sell more products, IT personnel at the distributor or logistics firm working operations on quality of data, optimization of shipping schedules, delivery routes), as project management is valued more in the area of IT especially coupled with relevant work experiences of IT personnel [25].

All these activities dealing with emergent changes and transformation from the IT stand-point (e.g., acquiring broad business knowledge, learning new technologies, collaborating with other business functions) present the IT unit and personnel unusual, yet difficult, challenges. In order to take on those challenges, IT personnel should be capable of understanding overall goal of organization and its strategic directions, effectively collaborating with business partners, learning and acknowledging different nuances of an organization dynamics and structures to execute any mission-critical projects on time and within budget. Especially, during the course of cross-functional collaboration in any forms, IT personnel should be capable of finding innovative and creative ways to leverage strengths of other business functions, and articulating idea and its impact to business-side, and resolving any conflicts (of interests or priorities).

Skills Set 4: Facilitation and Promotion of IT

Most of IT personnel's jobs evolve working with different lines of business. Those jobs often include attentive facilitation of IT resources and timely promotion of IT initiatives and solutions due to increasing pattern of in-house development of IT systems and complex IT integration [3].

Thus, IT personnel need to be more business-focused with thorough understanding of an organization's current position and strategic directions as well as relevant domain knowledge. In doing so, IT personnel need to be a unwavering and trustworthy source of information and business solutions that other members of an organization rely on [16]. IT personnel should also be persistent and capable of dealing with organizational obstacles while executing IT-related actions whenever needed, articulating how IT can be a viable option from business stand-point, and coherently encouraging strategic use of IT for an organization's benefit.

RESEARCH METHOD AND ANALYSIS

We administered Web-based survey and data was collected from 217 IT personnel comprised of 33 organizations across various industries. We conducted explanatory factor analysis (EFA) to incorporate emerging and changing features added to existing skill sets in IT academics and practitioners. Our analysis indicated *4* categories of specific skills. In addition,

empirical study using Partial Least Square (PLS) analyses showed how four skill sets affect IT personnel's level of work satisfaction. We present details about preparation and administration of our research survey as well as data analyses.

Procedure

To administer the survey, we compiled a list of prospective organizations located in northwestern part of United States in collaboration with northwest chapter of Society for Information Management (SIM). The initial list included 145 organizations across various industries.

We emailed the survey invitation to the head of IT units/operations in 145 organizations on the list of identified organizations, which included the link to our Web survey prepared on the secure network. Once the contact agreed to participate, then the head of IT forwarded invitation to his/her IT personnel of any positions. We provided all contacted IT personnel with full autonomy to participate or decline to participate. We had 15 of 145 invitations filtered out or bounced back due to either incorrect or out-dated contact information.

Among 35 heads of IT units/organizations who agreed to participate, 33 organizations had their IT personnel completed their surveys. Thus, in total, 33 of 145 organizations responded and participated in the survey (a response rate of about 22%), which is higher than a typical 10% response rate of web survey. From 33 organizations, we collected survey responses from total of 217 IT personnel. Table 1 displays the descriptive statistics of survey respondents and the composition of their corresponding organizations.

Table 1: Descriptive Statistics

IT Personnel (N=217)		
	# of Respondents	% of Respondents
Gender		
Male	146	67.3%
Female	64	29.5%
No Responses	7	3.2%
Age		
Under 25	1	0.5%
25-30	11	5.1%
31-35	18	8.3%
36-40	31	14.3%
41-45	43	19.8%
46-50	29	13.4%
Over 50	68	31.3%
No Responses	16	7.4%
Average Age (missing = 16)	*Mean = 45.45*	*Std. Dev = 9.15*
Education		
High School	17	7.8%
Junior College	28	12.9%
College	84	38.7%
Graduate	52	24.0%
Post Graduate	28	12.9%
Other	8	3.7%

Table 1: Descriptive Statistics (cont.)

IT Personnel (N=217)		
	# of Respondents	% of Respondents
Tenure in position		
Less than 1 year	21	9.7%
1 - 2 years	33	15.2%
2 - 5 years	74	34.1%
More than 5 years	85	39.2%
No Responses	4	1.8%
Average Years (missing = 4)	*Mean = 3.05*	*Std. Dev = 0.97*
Tenure in organization		
Less than 1 year	12	5.5%
1 - 2 years	21	9.7%
2 - 5 years	48	22.1%
More than 5 years	133	61.3%
No Responses	3	1.4%
Average Years (missing = 3)	*Mean = 3.41*	*Std. Dev = 0.88*

Organizations		
	# of Respondents	% of Respondents
Organization Type		
Publicly-traded	99	45.6%
Privately-owned	56	25.8%
Government or state-owned	46	21.2%
Non-profit	7	3.2%
Other	9	4.1%
Industry Type		
Financial services	10	4.6%
Manufacturing	28	12.9%
Transportation	83	38.2%
Education	3	1.4%
Technology	21	9.7%
Media/Publishing	0	--
Pharmaceutical	0	--
Agriculture	0	--
Food	4	1.8%
Healthcare	21	9.7%
Government	30	13.8%
Other	17	7.8%

Table 1: Descriptive Statistics (cont.)

Organizations		
	# of Respondents	% of Respondents
Annual Sales ($ Million)		
< 20	5	2.3%
21 - 50	4	1.8%
51 - 100	9	4.1%
101 - 500	24	11.1%
501 - 1,000	14	6.5%
> 1,000	49	22.6%
No Responses	112	51.6%
# of Employees		
< 20	23	10.6%
21 - 50	36	16.6%
51 - 100	33	15.2%
101 - 500	41	18.9%
501 - 1,000	36	16.6%
> 1,000	26	12.0%
No Responses	22	10.1%

We also collected responses on individual (IT personnel's gender, level of education, tenure on their current position and organization) and organizational (number of total employees and total sales) variables to control external variances. None of control variables showed impact on total variance of the model. *Note* that we did not ask all participants' current position titles to ensure the anonymity of respondents and full confidentiality of their responses, as small or medium-sized organizations tended to have small IT operations with one personnel taking care of one particular IT task (e.g., one systems administrator, one network administrator, etc.).

Measures

IT personnel's skills set

We used a valid 26-item IT skills questionnaire developed previously [22, 40]. As we discussed, current trend shows that most IT professionals' pervasive nature of tasks makes their requisite skills close to the one previously required only for systems analysts or knowledge acquisition workers [7, 25, 35, 36] -- IT personnel need to have skills and attributes to be effective in accurate specification of users' IT needs and their business priorities acquiring, refining, and structuring declarative and procedural knowledge by communicating and interacting with users and domain experts. All items were responded using a 7-point Likert scale (1=strongly disagree to 7=strongly agree) and are available in APPENDIX A: SURVEY ITEMS.

Mykytyn et al. [40] and Green [22] found 5 distinct categories of skills. However, as organizational expectation toward its IT resources is changing and more strategic role that an IT unit assumes, we need to rethink of previous categorization of IT personnel's sets of requisite skills. Thus, we conducted a series of EFA using the Principal Component Extraction method and Varimax Rotation. After the first EFA, we omitted 5 items due to either a low average (<5.0 out of 7.0) or a low loading (<0.50) (consult Table 2). Those items were to assess non-verbal communication (reinforcing the message to experts through gestures and facial expressions), liberal arts (being broadly educated and well-informed; knowledge of subjects dealing with humanities, philosophy, literature, etc.), leadership (getting work done while keeping parties involved in knowledge acquisition and other phases of expert systems development satisfied), sensitivity (being aware of the implications of changes in how experts structure their knowledge), and sense of humor (being able to appreciate

or express what is funny, amusing, or even ludicrous). Considering that a majority of data sample came from operational (entry)-level IT personnel, these items were irrelevant or inappropriate. With final EFA (Table 3), remaining 21 items converged to 4 factors. We discuss the result in data analysis section in details.

Table 2: Initial EFA of 26-Item IT Personnel's Skills

N	Mean	Std. Dev.	Skill/Trait
216	6.63	0.842	Interviewing
213	6.39	0.903	Listening
211	6.34	0.909	Hindsight
213	6.32	1.011	Speaking
213	6.28	0.919	Open-minded
209	6.24	1.079	Cooperation
213	6.21	1.049	Writing
215	6.15	1.068	Diplomacy
206	6.11	1.030	Management
205	5.97	0.857	Leadership
214	5.89	1.123	Amiable
212	5.89	1.125	Organizational Knowledge
211	5.85	1.057	Probing
200	5.81	1.101	Patience
210	5.80	1.110	Tolerant
204	5.74	1.147	Rational Thinker
200	5.74	1.095	Conceptualize
214	5.73	1.083	Empathy
208	5.58	1.294	Politics
189	5.55	1.089	Sensitivity
210	5.39	1.141	Domain Knowledge
209	5.21	1.456	Sense of Humor
207	5.16	1.354	Assertiveness
206	5.13	1.233	Salesmanship
208	4.80	1.413	Nonverbal Communication
208	4.53	1.627	Liberal Arts Knowledge
Average	5.79	Valid N = 138 (Listwise)	

Table 3: EFA Result

Component				
1	2	3	4	Specific Skill
.733	.123	.083	.271	Probing
.722	.335	.277	.086	Listening
.718	.122	.136	.126	Conceptualize
.655	.556	.102	-.045	Interviewing
.592	.529	.082	-.013	Hindsight
.576	.379	.285	.075	Open-minded
.568	-.008	.242	.028	Patience
.523	.341	.133	.190	Rational Thinker
.230	.765	.120	.085	Management
-.086	.649	.341	.382	Politics
.232	.640	.402	-.054	Cooperation
.520	.611	.252	.059	Speaking
.536	.543	.201	-.065	Writing
.087	.045	.864	.018	Amiable
.302	.204	.727	.017	Tolerant
.249	.365	.691	-.066	Diplomacy
.247	.263	.629	.268	Empathy
.168	.496	.531	.106	Organizational Knowledge
.153	.085	.121	.835	Salesmanship
.052	.034	-.060	.798	Assertiveness
.500	.001	.105	.535	Domain Knowledge
* Principal Varimax Rotation was used.				

Proxy for IT Personnel's Quality of Work-Life (QWL)

With our findings in 4 sets of IT personnel's requisite skills, we wanted to gauge the impact of IT personnel's requisite skills on their perceptions at work leading to their job- and career-decisions. For that investigation, we employed a proxy measure – QWL. QWL refers to IT personnel's perceived satisfaction with their job and work in regards to a variety of needs through resources, activities, and outcomes stemming from participation in the workplace and measures IT personnel's psychological results of evaluations of the products of organizational work: discrepancy between outcome (e.g., economic rewards, promotion opportunities, challenges, co-worker relations, etc.) and standard and the weight of each outcome (e.g., expectations, values, motives, wants, social comparisons, etc.)[15].

As their competencies are developed or improved through having requisite skills, IT personnel are likely to be more satisfied with their work [24]. This, in turn, is expected to lead IT personnel to feel that they are involved in more meaningful work and become more confident and active [27]. IT personnel with requisite skills set are likely to stay with their positions reducing their turnover [13, 29]. That is, we expect IT personnel' skills to positively affect their evaluation of needs satisfaction at work (QWL)[15]. As IT personnel develop or improve their competencies in line with requisite skills, their self-efficacy and self-regulation of motivation to work will increase. This will lead IT personnel to feel more confident, be more active, and seek innovative, persuasive ways to work with others.

We used a valid 5-item questionnaire with a 7-point Likert scale (1=strongly disagree and 7=strongly agree). Used items include "My overall quality of work life in this company is high", "I have the right level of autonomy in making my decision", "I feel my job is very important", "I have a very good relationship with other employees", and "I can make my decision on the task I am in charge on my own".

Results

Descriptive Statistics

Table 1 shows all key descriptive statistics on the data samples. Total of 217 IT professionals responded at the average age of 45, who were largely male (67.3%) with a higher education background (62.7% with college or graduate degrees). Most of them held their current IT positions at the time of completing the survey for 2 years or more (77.3%; mean=3 years) at the current organizations (84.3%; mean=3.4 years).

Participating 33 organizations represented various types of industry: financial services (4.6%), manufacturing (12.9%), transportation (38.2%), education (1.4%), technology (9.7%), food (1.8%), healthcare (9.7%), government (13.8%), and others (e.g., services, recruiting, retirement home, etc.)(7.8%). Half of those were publicly-traded organizations (45.6%) with the rest being either privately-owned (25.8%) or government agencies (21.2%). About half of organizations had more than $100 million in total sales (40%) and more than 100 employees (47.5%). These statistics showed an adequate representation of organizations in various sizes (consult Table 1). Table 4 presents inter-correlations among all variables of interest in our research.

Table 4: Inter-correlation among Constructs of Interest

	Personal Traits	Communication & Problem-Understanding	Collaboration & Project Management	IT Facilitator & Promotion	QWL
Personal Traits	1.000	---	---	---	---
Communication & Problem-Understanding	0.621**	1.000	---	---	---
Collaboration & Project Management	0.686**	0.787**	1.000	---	---
IT Facilitator & Promotion	0.328**	0.338**	0.364**	1.000	---
QWL	0.106	0.090	0.082	0.041	1.000
** Significant at .01 level (2-tailed); N=214 using 'Listwise' for missing values					

Data Analysis

EFA on IT Personnel's Requisite Skills

Final EFA result revealed 4 distinct categories of specific skills required on the part of today's IT personnel. These skill sets are personal traits, communication and problem-understanding, collaboration and project management, and IT facilitation and promotion (Table 5). Personal traits include innate skills that make IT personnel amiable, tolerant, empathetic, and diplomatic while interacting with their internal and external partners and clients. Communication and problem-understanding skills encompass soft skills with which IT personnel can be effective in communication with others to investigate business problems such as interviewing, listening, open-minded, and patience. They also include skills such as probing, conceptualization, hindsight, and rational thinking while striving to fully understand business problems.

With personal traits and communication and problem-understanding skills in place, IT personnel need to have skills such as management, politics, cooperation, speaking, writing, and organizational knowledge that will make them more effective in collaboration with key business partners and successful in managing mission-critical IT projects. IT facilitation and promotion skills cover IT personnel's domain knowledge of their business counterparts, salesmanship, and assertiveness to stand put with their firm IT belief.

Table 5: IT Personnel's Critical Skills Set

Category	Specific Skill
Personal Traits	Amiable
	Tolerant
	Diplomacy
	Empathy
Communication & Problem-Understanding	Probing
	Listening
	Conceptualize
	Interviewing
	Hindsight
	Open-minded
	Patience
	Rational Thinker
Collaboration & Project Management	Management
	Politics
	Cooperation
	Speaking
	Writing
	Organizational Knowledge
IT Facilitation & Promotion	Salesmanship
	Assertiveness
	Domain Knowledge

IT Personnel's Requisite Skills and Satisfaction at Work (QWL)

In line with prior literature, all 4 sets of specific skills show positive and significant correlation which supports our thinking of personal traits and communication and problem-understanding skills would make collaboration and project management and IT facilitation and promotion skills that much better (Table 4).

Result from PLS analysis using blindfolding method further support our thinking (Table 7). As shown in Table 6, all constructs used in PLS analysis (4 skill sets and QWL) met suggested levels of psychometric properties (Cronbach's α, AVE, and composite reliability). Cronbach's alpha for the four categories of IT personnel's skills met recommended threshold of 0.7 [42]: 0.83 for personal traits, 0.88 for communication and problem-understanding, 0.86 for collaboration and project management, 0.69 for IT facilitation and promotion and 0.81 for QWL).

As summarized in Table 7, IT personnel's collaboration and project management skills are positively affected by their personal traits ($\beta = 0.38$; $p < 0.01$) as well as communication and problem-understanding skills ($\beta = 0.52$; $p < 0.01$). IT personnel's skill on IT facilitation and promotion is positively affected by their communication and problem-understanding skill ($\beta = 0.40$; $p < 0.01$). Then, we examined how these advanced skills set affect IT personnel's QWL. IT personnel's collaboration and project management skills are positively associated with their QWL ($\beta = 0.15$; $p < 0.05$), while IT facilitation and promotion skills are negatively associated with QWL ($\beta = -0.17$; $p < 0.05$). *Note* that we used 'intention to stay' which is another widely-used proxy for job-oriented satisfaction [13] in the same structural model. 'Intention to stay' refers to IT personnel's overall intention to stay on the positions in their current organization. Our analysis showed similar significant results as with QWL.[1]

[1] Result will be provided upon request.

Table 6: PLS Psychometric Properties

	AVE	Composite Reliability	Cronbach's α
Personal Traits	0.655408	0.883764	0.826827
Communication/Problem-Understanding	0.554008	0.907149	0.881345
Collaboration/Project Management	0.586345	0.894251	0.858274
IT Facilitator/Promotion	0.597348	0.811084	0.692035
QWL	0.451373	0.795284	0.815157

Table 7: Path Coefficients

Path	β-coefficients	T-Statistics
Personal Traits → Collaboration & Project Management	0.381697**	7.093919
Personal Traits → IT Facilitator & Promotion	0.041423	0.795216
Communication & Problem-Understanding → Collaboration & Project Management	0.524675**	7.488745
Communication & Problem-Understanding → IT Facilitator & Promotion	0.402083**	4.130632
Collaboration & Project Management → QWL	0.147715*	2.001934
IT Facilitator & Promotion → QWL	-0.168272*	1.957058
* Significant at .05 ** Significant at .01		

DISCUSSION

As more business organizations realize the importance of the IT unit and its personnel to be equipped with more encompassing set of knowledge and skills to fully leverage IT investments to champion organizational strategies, this study provides several key findings and management implications worthy of further discussion.

First, it will be imperative to start with (hire or select) IT personnel (pre-) equipped with right mix of fundamental skills in the areas of individual traits (e.g., tolerance, empathy, diplomacy, friendlessness, etc.) and communication and problem-understanding skills (e.g., listening, patience, interviewing, probing, etc.). For example, an organization (or a head of IT unit) may consider using individual psychometric assessment tools as the Myers-Briggs Type Indicator (MBTI) and StrengthQuest on IT personnel as a coherent and practical first step. Then, as a reasonable next step, an organization helps IT personnel building or developing advanced skills (collaboration and project management and IT facilitation and promotion skills) on top of such foundations to ensure that they are ready and competent to undertake mission-critical IT tasks. In that regard, it tends to make sense to observe more and more business schools and organizations administering such assessment tools to measure students' and the employees' psychological preferences in how they perceive the world and reach decisions.

Second, due to cross-functional and strategic nature of most IT tasks and activities these days [11], possessing skills instrumental in collaboration and project management positively affect IT personnel's satisfaction at work and self-fulfillment, which is also likely to affect IT personnel's job- or career-related decisions. To make sure that all IT personnel possess this skill set, it may be instrumental to use one-on-one mentoring or coaching on the job, continuous professional development sessions and training, and job rotation across different functions. On the other end, IT facilitation and promotion skills adversely affect IT personnel's work-related satisfaction. This may imply that either IT personnel with a lack of such skills feel uncomfortable in executing IT tasks requiring IT facilitation and promotion skills or being asked to use such skills constantly in IT tasks is stressful leading to their dissatisfaction. *Note* that leadership on the part of the head of IT operations (e.g., Chief Information Officer) can play an important role in motivating and encouraging IT personnel to develop or harness both advanced skills, which in turn leads to higher level of work satisfaction [4, 47]. Future study may want to examine the impact of IT leadership.

Lastly, it is very important to know that one can educate or train these critical skills (even personal traits). Most practitioners believe that it is easier to develop

these skills in students than in experienced workers, as students tend to be more open to new ideas free of work patterns and habits [1]. Thus, there should be a concerted effort by both IT education and practitioners to amend a gap between 'what is taught in classes and 'what is required on the job'. A logical first step may include re-evaluating current IT curriculum in business schools incorporating courses such as interpersonal- and organizational communication, public speaking, collaboration and group interactions as a part of IT curriculum requirements, in which future IT professionals can be exposed to non-IT traditional skills critical for today's IT tasks.

CONCLUDING REMARKS

We aim to shed lights on IT professionals' changing requisite skills set and its impact on their job-oriented satisfaction leading to career decisions. We present four distinct sets of critical skills today's IT professionals should possess to be competent and relevant. Our findings and results suggest that, to be competent and relevant IT personnel, one should start with fundamental skills such as interaction-oriented personal traits and communication and project management skills, then develop advanced skills in collaboration, project management, and IT facilitation and promotion. Our findings also show that those skill sets play an important role in the retention of existing IT workforce. Lastly, as current IT education must find a right balance between traditional technology skills and non-IT skills, we expect our findings to be valuable information to current IT education at college and university level.

Although this study provided a number of valuable information, it is not free from limitations. Those limitations must be acknowledged to correctly interpret our findings. First, current study used one method for all data collection (Web-based questionnaire). We administered the survey to one source (IT professionals responding to all survey items). Thus, common method variance (CMV) may have influenced our findings [37, 43]. Adding objective measures such as retention rate, turnover ratio of IT personnel from participating organizations would have helped the study avoiding this problem and examining much accurate causal relationship of critical requisite skill sets.

Secondly, the study took a direction with evaluating all IT positions across the industry based on strategic orientation of today's IT work and for generalizability purpose of its findings. We did not capture the positions of all respondents in order to ensure confidentiality and anonymity of all responses. That being said, it would have been beneficial to refine the confinement of the study's cope on specific industry and/or specific positions as across positions and industry may dilute the variance.

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APPENDIX A: SURVEY ITEMS

Survey Items: IT Personnel's Skill Sets

Diplomacy	Being able to say no without being too blunt; displaying tact in dealing with others; being sensitive to the feelings, pride, and prestige of others.
Interviewing	Asking the right questions in order to obtain the information needed.
Patience	Refining an expert's belief and points of view; tolerating an expert's possible lack of computer literacy and specificity.
Assertiveness	Insisting on a course of action or what one believes in, even though it may be unpopular.
Leadership	Getting work done while keeping parties involved in knowledge acquisition and other phases of expert systems development satisfied.
Speaking	Presenting your ideas in a manner easily understood by the expert(s), both in group meetings and person-to-person.
Writing	Preparing written documents that accurately communicate ideas in a manner that is easily understood by intended readers.
Listening	Paying attention to and concentrating on what is said, and asking questions that refine points about which one is uncertain.
Empathy	Being able to understand how others feel; accurately determining what someone else thinks about an issue.
Salesmanship	Promoting your viewpoints regarding how expert knowledge is represented; persuading the expert to accept your viewpoint.
Politics	Understanding what motivates individuals; determining sources of power and influence in an organization.
Management	Planning, organizing, and controlling expert system projects so that they get done on schedule and within budget.
Cooperation	Working with others productively; resolving conflict in an effective manner.
Nonverbal Communication	Reinforcing the message to experts through gestures and facial expressions.
Sensitivity	Being aware of the implications of changes in how experts structure their knowledge.
Domain Knowledge	Possessing a strong working knowledge of the expert's domain.
Open-minded	Having a mind open to new ideas both before and during knowledge elicitation sessions; being unprejudiced.
Probing	Investigating and scrutinizing thoroughly the expert's knowledge and responses; encouraging the expert to provide more information.
Conceptualize	Decomposing an expert's knowledge into its parts; providing a structure to the knowledge and establishing relationships among the parts.
Sense of Humor	Being able to appreciate or express what is funny, amusing, or even ludicrous.
Rational Thinker	Drawing inferences or conclusions from known or assumed facts.
Hindsight	Understanding, after the event, of what should have been done; the ability to draw upon and apply past experience.
Liberal Arts Knowledge	Being broadly educated and well-informed; knowledge of subjects dealing with humanities, philosophy, literature, etc.
Tolerant	Recognizing and respecting the beliefs and practices of others.
Amiable	Having a pleasant disposition; being good-natured and friendly.
Organizational Knowledge	Having a broad view of company goals and operations; knowing the orientation of senior management.

Survey Items: IT Personnel's Quality of Work-Life

My overall quality of work life in this company is high
I have the right level of autonomy in making my decision
I feel my job is very important
I have a very good relationship with other employees
I can make my decision on the task I am in charge on my own