Defining the Essential Skill and Functional Areas of Study in Information Technology as Measured by a Survey of Field Professionals

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Abstract

This paper reports the survey results of a representation of the Southwestern Pennsylvania regional technological corporate community. The purpose was to determine what Areas of Study in Information Technology these professionals consider essential, usable, and non-applicable to the current corporate workforce in their respective organizations. Specific skills of a technological nature, as well as general areas of computer-related functional competencies, such as networks and databases, were derived through a questionnaire response. The results were tabulated to identify the key technological skills considered essential to higher education curricular offerings in Information Technology programs.

Keywords: IT areas of study, IT corporate skills, CIS curriculum development, university corporate partnerships

1.　Introduction

Information Technology (IT) has rapidly become one of the largest segments of the U.S. economy. In Southwestern Pennsylvania, the IT cluster (Paytas, 2001) contains more than 1,600 firms that employ more than 39,000 workers, and has accounted for 15% of the region's job growth over the past decade. This rapid expansion is a challenging and an ongoing undertaking for educators in institutions of higher education that prepare Information Technology professionals. In order to meet this challenge, data must be continually collected and analyzed to determine the relevancy and the adequacy of its programs and courses (Modzelewski, 2002). Information Technology professionals can provide valuable feedback to universities concerning what areas of study and competencies are critical. These areas of study and competencies can then be identified as valid entities that must be integrated into the Information Systems programs of colleges and universities.

This study relates to, and captures, the expertise of professionals who are involved in the Information Technology field. A survey was conducted from a representation of the Southwestern Pennsylvania regional technological corporate community with the following objectives:

1. To identify the areas of study in Information Technology that are essential and directly applicable to Information Technology workforce requirements as assessed by field professionals.
2. To determine how the critical areas of study in Information Technology relate to the functional roles of Information Technology professionals.
3. To determine how the areas of study in Information Technology relate to the dimension and size of firms.

The gathering and evaluation of such information could be of value to the following institutions and individuals.

1. Information Technology departments in business, industry, and education as an aid in determining standards

for the selection and education of their personnel.
2. Students enrolled in Information Technology programs.
3. Individuals employed in Informational Technology who can benefit from an analysis of areas of study in IT with the possibility of being motivated toward self-improvement and preparation for advancement.

2.   ASSUMPTIONS

This study is predicated upon the following assumptions:

1. Those individuals surveyed are a representative sample of Information Technology practitioners in the Information Technology Southwestern Pennsylvania corporate district.
2. Professionals surveyed are currently using or have used the information skills and business intelligence in their functional role.
3. The individuals surveyed can identify their needs in relation to Areas of Study and Competencies in Information Technology.
4. A survey of Information Technology professionals is crucial to the revision and development of higher education programs if such programs are to service the needs of students and working professionals.

3.   POPULATION

The total population for this study included professionals who are involved with Information Technology in business, industrial, governmental, and service organizations in Southwestern Pennsylvania. This includes over 1600 corporations within the Pittsburgh Technology Council (PTC), the Association of Information Technology Professionals (AITP), and the corporate Education Career Services partners with Robert Morris University. The geographic area of this population included the city of Pittsburgh and Allegheny County as well as surrounding southwestern Pennsylvania counties, including Washington, Butler, Beaver, and Westmoreland. This population is expected to provide sample statistics that suggest the skills standards of Information Technology professionals and organizations locally and, to some extent as a general reference, for other urban areas in the United States.

4.   DATA COLLECTION AND RESEARCH SAMPLE

In order to meet the objectives of this study, it was necessary to collect, analyze, and summarize data. A variety of research tools have been developed to aid in the gathering of data. The most common are the interview and the questionnaire. Since the population for this study was widely distributed in a number or organizations, the expense and the time required to acquire all data from them by the interview would have been excessive. Consequently, the questionnaire was chosen as the logical means of gathering data.

The design of the questionnaire included the following three main parts:

Part I - Personal and Corporate Profile to collect data about the background, experience, corporate hierarchical level, IT service, degrees attained and current professional status of the respondents.

Part II - Areas of Study to collect data concerning curriculum.

Part III - Competency Profile developed to elicit information concerning the development of competencies associated with Information Technology.

For the purpose of the paper, only portions of the data from Part I and Part III of the questionnaire is used. Thus, this study initiates and defines the first phase of a comprehensive assessment of corporate and collegiate workforce attributes and relationships.

The questionnaire, accompanied with a cover letter, was mailed during the period of February through May 2004. Whenever possible, follow-up calls or on-site visits were made to enhance the validity and response of the instrument. Of the 135 questionnaires mailed, 91 (67 percent) were returned. The returns of 10 respondents were unusable because they devoted insufficient time to IT activities or contained ambiguous data. This reduced the number of usable returns from 91 to 81 (89 percent). These

81 returns became the basis for the analysis of data and are referred to as the sample for this study. The number of corporations surveyed in this sample was 70. In a few cases, those corporations having large and diverse IT departments with multiple supervisors and managers in various departments or divisions provided more than one response per corporate entity.

5. ANALYSIS OF DATA AND FINDINGS

The eight areas of study measured for critical skill formulation were:

1. Software development
2. Network Administration (including Certifications)
3. Web Development and Programming
4. Multimedia and Graphics
5. Office Software (Database Software as the major component)
6. Project Management
7. System Development Tools and Technology
8. Business/Information Intelligence

Each respondent rated the functional areas as "essential", "useful", or "non-applicable". Only the "essential" scores are used in the final analysis of the data. The other two categories only provide the semantic framework to guide the respondents in assessing which choice best described their environment. The findings reflect the percentage of "essential" responses compared to total responses.

Within each area of study, there are multiple selections. As an example, included under the category for Software Development/Programming were programming languages such as C++, Java, COBOL, Visual Basic, and other current software. Each was rated by the surveyed participants as "essential" or not, as well as generating the overall response for the category.

Area of study related to functional roles.

The three functional roles derived from the responses of the corporate practitioners are as follows:

Managerial: This category encompasses broad-based managerial activities in Information Technology, such as IT managers and directors, Chief Information Officers, project leaders, systems designers and analysts, application development leaders and similar roles.

Technical. This category encompasses more narrow-based activities, such as programmer, network technician, technical support, web designer, database developer and similar roles.

Other: This category comprises consultants, contractors, engineers, users of IT technology and managers in fields other than Information Technology that were required to interact closely with IT departments (Ware, 2002).

The following three tables compare essential Area of Study skills by functional role.

Table 1 Managerial Category

Area of Study	Frequency (%)
Business Information Intelligence	94%
Office Software	84%
Project Management	70%
Network Administration	61%
Systems Development	47%
Software Development /Programming	37%
Web Development	37%
Multimedia/Graphics	17%

Table 2 Technical Category

Functional role	Frequency (%)
Business Information Intelligence	91%
Office Software	89%
Network Administration	76%
Project Management	66%
Software Development /Programming	34%
Systems Development	30%
Web Development	25%
Multimedia/Graphics	19%

Table 3 Other Category

Functional role	Frequency (%)
Business Information Intelligence	87%
Office Software	80%
Project Management	69%
Network Administration	45%
Web Development	44%
Systems Development	42%
Software Development /Programming	41%
Multimedia/Graphics	32%

A review of all three tables reveals that the most essential area of study is Business Information Intelligence. More than 85 percent of the sample indicated this need regardless of category. As with Business intelligence, Office Software was the next essential area of study in all three categories with more than an 80 percent response. Project Management preceded Network Administration in the Managerial Category and Network Administration preceded Project Management in the Technical Category. Respondents in the Management Category indicated Systems Development more essential than Software Development and respondents in the Technical Category indicated the reverse. Web Development is deemed more essential than both Systems Development and Software Development/Programming in the Other Category. Multimedia/Graphics was the least essential area of study regardless of category.

Area of study related to corporate size.

The following three categories of corporate dimension were employed for the study.

Dimension 1: Corporations that are generally young, entrepreneurial, single-site local firms with less than 100 employees.

Dimension 2: Corporations are generally rapidly growing entities that often maintained multiple sites in the local areas and can maintain up to 999 employees.

Dimension 3. Corporations representing those firms that are often multi-national, multi-divisional and multi-sited in nature and have an employee force up to 28,000.

The following three tables compare essential Area of Study skills by corporate dimension**.**

Table 4 Dimension 1

Area of Study	Dimension 1
Business Information/Intelligence	92%
Office Software	87%
Project management	72%
Network Administration	67%
Systems Development	47%
Web Development	36%
Software Development and Programming	35%
Multimedia/Graphics	15%

Table 5 Dimension 2

Area of Study	Dimension 2
Business Information/Intelligence	89%
Office Software	82%
Project management	64%
Network Administration	60%
Software Development and Programming	34%
Web Development	29%
Systems Development	25%
Multimedia/Graphics	22%

Table 6 Dimension 3

Area of Study	Dimension 3
Business Information/Intelligence	80%
Project management	77%
Office Software	66%
Network Administration	51%
Systems Development	34%
Web Development	30%
Software Development and Programming	27%
Multimedia/Graphics	20%

As with the functional role (category) of the respondents, the most essential area of study is Business Information Intelligence. More than 80 percent of the sample indicated this need regardless of corporate dimension. Office Software and Project Management were the next two essential area of study for those in young, entrepreneurial,

single-site local firms and rapidly growing entities that often maintained multiple sites in the local areas whereas those in multi-national, multi-divisional and multi-sited areas revealed Project management followed by Office Software more essential. Project Management preceded Network Administration in the Managerial Category and Network Administration preceded Project Management in the Technical Category. Those in the Management Category indicated Systems Development more essential than Software Development and those in the Technical Category indicated the reverse. Web Development is more essential than both Systems Development and Software Development and Programming in the Other Category. Multimedia/Graphics was the least essential area of study regardless of corporate dimension.

7.   SUMMARY AND RECOMMENDATIONS

Seven of the eight categories in the areas of study relate directly to core information systems courses required in both ABET accredited information systems degree programs offered by the Computer Information and Systems Department of Robert Morris University. Both degree programs share a common design that is tightly coupled to AITP's IS-2002 model curriculum. The eighth area of study was added in response to feedback from prior assessment surveys. The results of previous surveys conducted by the CIS Department indicated that corporate information technology managers recognized that "business intelligence" or "business information" or "competitive information intelligence" to be a potential area of study that would be of major value to their corporations.

Business Information/Intelligence is an elusive skill to categorize, and perhaps not easily meshed into the curricular offerings of the modern higher education system. It is not a single-entity skill, but rather a fusion or combination of assets, insights, capabilities and processes adaptable to the Information Technology discipline. Some definitions that employers used are "Logical thought processes", "Integrated IT capabilities", "Techno-business acumen", Intellectual productivity assets", and "Integrated IT capabilities." For clarity and standardization purposes, the

definition proposed to the IT community by these researchers is that "Business/Information Intelligence is the ability to fuse corporate business goals and objectives with relevant and powerful technological processes." By any measure, it was regarded as a coveted, highly desirable asset for any IT employee to possess (Smith et al., 2001).

In General, there were not extensive differences in the essential skills areas of study either among management types or due to the size of the organization. While it would be difficult to determine which skill areas of study are declining without follow-up studies, it can be noted that IT management timed their assessments to current and short-term future needs. In this light, we find that four areas of study are clearly ascendant. These areas include Business/Information Intelligence, Project Management, Office Software and Network Administration. Business/Information Intelligence was the skill area that was deemed to be most essential by all levels of management in all sizes of organizations. The very high percentages displayed in the Office Software and Project Management were unexpected in that they were marked increases from the results of previous educational/corporate assessment devices.

Overall, the fact that the IT managers used a current and short-term horizon for their responses indicates that close monitoring of course content, detail, emphasis, tracks, concentrations, course articulation and integration and advanced study factors would be in order for the responsive Information Technology educator.

Finally, a few suggestions that are not specifically tied to the construction of an Information Technology curriculum are as follows:

Student surveys should be devised to determine which mix of enrolled skills match up with industry norms.

Corporate survey data and findings should be made available to students.

Corporate ties and liaisons should be encouraged for faculty and students in the IT field.

Membership for faculty and students in the professional associations and councils should be encouraged.

Internships that match student skills directly to corporate needs should be instituted. Follow-up surveys should be undertaken on a timely basis to detect advancing technological directions and developments.

8. REFERENCES

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