# Anticipated changes to technologies employed by IT departments in 2009

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## Abstract

One of the major challenges facing any Information Technology (IT) professional is the need to stay current in the field. Changes to databases, web technologies, and server platforms demand IT professionals upgrade their skills. This research summarizes the results of an employer survey conducted at four different universities and their service areas in 2007. The survey queried current IT professionals on current and anticipated changes in the usage of technologies in the areas of databases, programming languages, networking, and operation platforms. Responses are summarized and compared to those obtained in a similar survey conducted in 2002/2003. Survey respondents indicated Windows Family dominance in Operating Platforms and Networking and Communication Software. In database products, MS SQL Server and Oracle lead the survey results. Finally, in programming XML showed the highest level of importance followed by the .Net languages, JAVA and PHP.

**Keywords**: IT Skills, IT Technologies

## 1. INTRODUCTION

The United States Bureau of Labor Statistics reports that in the 2004-2014 period Information Systems (IS) and Information Technology (IT) jobs have the second highest growth rate and demand in the United States (US Bureau of Labor Statistics, 2005). Fortune Magazine also reports that IT occupations comprise six of the top twenty growth jobs (Fortune Magazine, March 2005). Concurrent with the demand for general IT professionals, is a need for experienced and knowledgeable professionals in specific IT areas such as databases, servers and programming languages.

A challenge for any computer information systems professional is to stay relevant and up to date with the evolving technologies demanded by employers. This is particularly true in a dynamically changing industry like Information Technology. Lee, Koh, Yen and Tang (2002) acknowledge that such rapid change causes difficulties for information systems' academics trying to cope with evolving course content.

This research was designed to identify current and anticipated changes in the usage of technologies (anticipated in the next 2 years) by employers in the service areas of the participating institutions. The research is a follow up study on a similar survey conducted in 2003 (Janicki, et. al. 2004). This paper also details the changes in technologies demanded by the IS industry since the initial survey.

## 2. LITERATURE REVIEW

Many researchers have considered matching employer needs to university curriculum. For instance, Lee et al. (2002), Woratscheck and Lenox (2002), Capel (2002), and Lee et al. (1995) each conduct employer surveys to assess the skills desired by IS employers. A similar study by Scott et al. (2002) contrasts employer expectations with student skills to identify areas where gaps occur. Areas with large gaps present opportunities where changes in curriculum can provide high marginal benefit to employers.

Medlin et al. (2007) compare the IT skills student perceive necessary to obtain a job in an IT related field to advertised IT skills de-

manded by employers. Several gaps between student perception and employer demand are identified.

Aken et al. (2007) investigates the recruitment trends based on the gap between the recruiter skill expectations from new graduates and what skills new graduates have. They emphasize that the current expectation on skills would not be representative of the prospective needs of the firms due to the rapid changing nature of IT.

Related research by Janicki et al. (2008) provides a more detailed examination of the job skills and knowledge needed for undergraduate and graduate degree IS students by summarizing the results of an employer survey querying job-hiring expectations. Unlike other hiring surveys the paper queries the detailed job skills required for specific occupations.

This paper extends the survey in Janicki et al. (2004) longitudinally to assess the changing needs of the IT community. Specifically we consider the current technology needs in the areas of databases, programming languages, networking, and operation platforms as well as how those needs have in the last four years.

## 3. METHODOLOGY

The development of the survey instrument was conducted in the four phases shown in Figure 1.

Phase I
In phase one, 20 professionals from various IT professions and responsibilities (i.e., members of a corporate advisory board), met with faculty in roundtable discussion groups to develop topic areas of importance to IT professionals. Specifically the professionals identified major technology areas and the technology (brand names) within those areas.

The roundtable groups were not provided with the technology areas from the 2003 survey, but rather were asked to identify the major technology areas for 2007. The professionals brought full job descriptions to the meetings so that the survey could 'group' similar job responsibilities into major tech-

nology categories. The team identified the following four major categories.

- Platforms
- Networking
- Languages
- Databases

- CISCO
- Juniper
- Linux/Unix
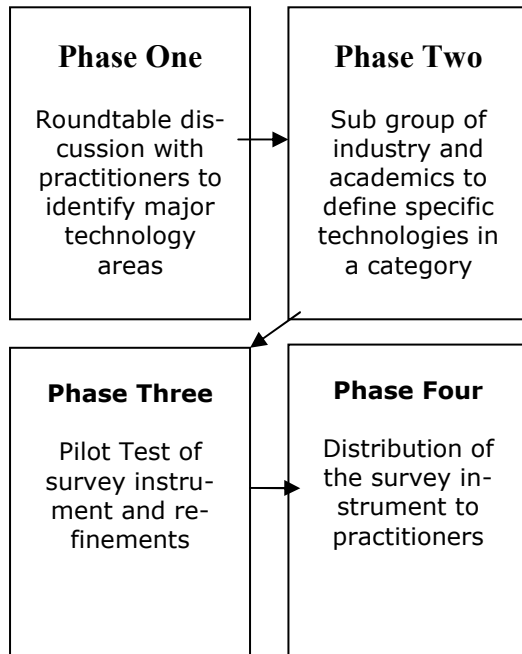- Netware
- Windows
- Wireless

| Expected importance to your job in two years |
|---|
| Minimal or None |
| Less Important than Today |
| Same as Today |
| More Important than Today |
| Extremely Important |

**Table 1**:
**Scale of the Change in Importance of Particular Technologies in two years (2009)**



**Figure 1: Survey Methodologies Stages**

**Phase One**

Roundtable discussion with practitioners to identify major technology areas

**Phase Two**

Sub group of industry and academics to define specific technologies in a category

**Phase Three**

Pilot Test of survey instrument and refinements

**Phase Four**

Distribution of the survey instrument to practitioners

## Phase II

A sub group of these professionals worked to define specific items and brand names within each major technology area. These 'sub-technology groups' went through several iterations and 'pilot testing' with other industry professionals to insure proper sub technologies were defined. Appendices B through F detail each technology area and brand names within each category.

The sub group of academics and industry professionals developed the scale for Industry professionals and decided to only focus on a two year time horizon due to the rapidly changing nature of the field. The scale developed is shown in Table 1.

For example, under the networking technology category, the outside professionals identified the following specific technologies and brands:

## Phase III

To insure that the survey would be clear to the participants and also able to be completed within a ten minute response limit, a pilot test was conducted. A preliminary survey request was emailed to twenty industry professionals. These individuals were directed to a web site to complete the survey. They were asked to record the time to complete the survey and to print any pages that were misleading and fax back any suggestions.

Following completion of this pilot test, the survey instrument was revised and ready for distribution.

## Phase IV

The request to complete the survey was emailed to 1002 individuals either in the IS/IT field or known to potentially hire IS/IT professionals. Of those contacted, 79 IT professionals completed the entire technology section of the survey. Note, all respondents did not complete the entire survey (over 200 other respondents completed other parts of the survey not included in this paper).

The survey's mailing list was developed by aggregating mailing lists from four different institutions. Two of the institutions were state affiliated universities and two were private institutions. The schools were located in North Carolina, Ohio and Pennsylvania.

The survey's mailing list was developed based on the following criteria:

a. members of the IS/IT advisory boards from each participating school

b. IS/IT professionals in the service area of each school

c. alumni from each participating institution

The survey instrument had two major branches. The branch each participant received was based on whether the individual managed (or hired) IT professionals or not (but did work in the field). Respondents to both branches were asked the same sample demographic questions (age, gender, location, company size, industry, job title) and whether they were responsible for hiring or supervising IS/IT professionals. If the individual indicated they worked in an IT role, they were asked about their current and anticipated technology needs.

### 4. Results

As described earlier, the survey request was emailed to 1002 IT managers, IT professionals, or individuals who hire IT personnel. Table 2 details the functional areas within which the respondents worked in their organization. Note, respondents were not required to complete all questions. Table 2 indicates the majority of the respondents were employed with the IT department of their organization.

**Demographics**

| Functional Area | # | % |
|---|---|---|
| Accounting | 3 | 3.8 |
| Corporate Administration | 3 | 3.8 |
| Information Systems | 60 | 75.9 |
| Sales | 6 | 7.6 |
| Other | 7 | 8.9 |

**Table 2: Functional Area of Respondents currently working in IT (Number and % of Respondents)**

Table 3 details the size of the organizations represented while table 4 details the type of organization for the respondents. The majority of respondents were from organizations with 1000 or more employees.

| Number of Employees | # of Respondents | % of Respondents |
|---|---|---|
| < 11 | 7 | 8.9 |
| 11 – 20 | 2 | 2.5 |
| 21-100 | 7 | 8.9 |
| 101-499 | 13 | 16.5 |
| 500-999 | 3 | 3.8 |
| 1000-9999 | 19 | 24.1 |
| >10000 | 28 | 35.5 |

**Table 3: Size of the organizations**

| Organization Type | Number of Resp. | % of Resp. |
|---|---|---|
| Corporation | 54 | 68.4 |
| Education | 7 | 8.9 |
| Government | 6 | 7.6 |
| LLC | 2 | 2.5 |
| Non or Not for Profit | 7 | 8.9 |
| Sole Proprietor or Partnership | 3 | 3.8 |

**Table 4: Organization Type**

Table 5 indicates where the respondent's company was located. The state distribution centered in NC, PA and OH is to be expected since this is where the participating institutions are located.

Other demographics include: 37% of the respondents were female while 62% were male; the majority of the respondents were younger with 43% under 30 and 29% between 30 and 40. Further over 50% of the respondents had been with their company less than two years while 12% had been with their firm over 10 years.

| Company Location | Number of Respondents |
|---|---|
| NC | 38 |
| PA | 16 |
| OH | 6 |
| VA | 6 |
| Other | 13 |

**Table 5: Company Location**

The survey outcomes are presented in the following subsections.

## 4.1. Platform Expectations

This area of the survey inquired the expected importance of five different platforms in the next two years. As stated earlier which platforms to include in the survey was determined by a panel of industry and advisory board professionals.
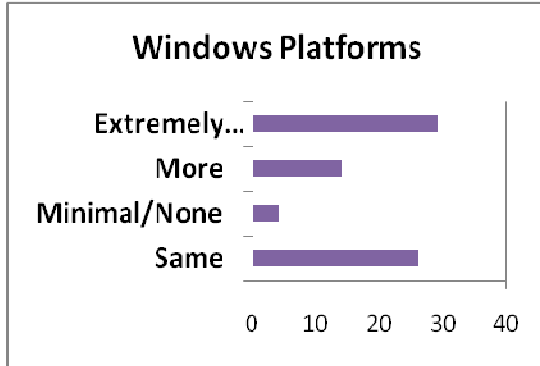


**Figure 1: Expected importance
of Windows Platforms**

Windows platforms dominated the survey responses in this category. The Unix/Linux family placed second in platforms. Mac OS, Palm and Windows CE placed in the bottom portion of this category. Figures 1 and 2 detail the top two platforms expected to have "more" or "extremely more" importance to IT professionals in the next two years. Appendix B details the responses of all platforms surveyed.
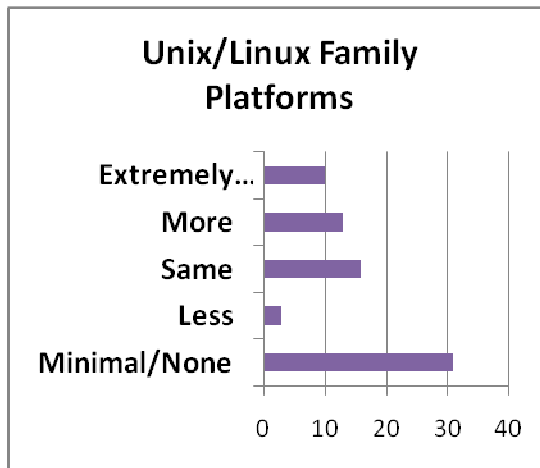


**Figure 2: Expected importance
of Unix/Linux Platforms**

## 4.2. Networking and Communications Software

The second area investigated was networking and communications software. In this category Windows networking and communications software was again the leader, showing the highest level of "extremely important" responses (as shown in Appendix C). Figure 3 details those responses. Respondents also noted the "increasing importance" for wireless networking software (as shown in Figure 4).
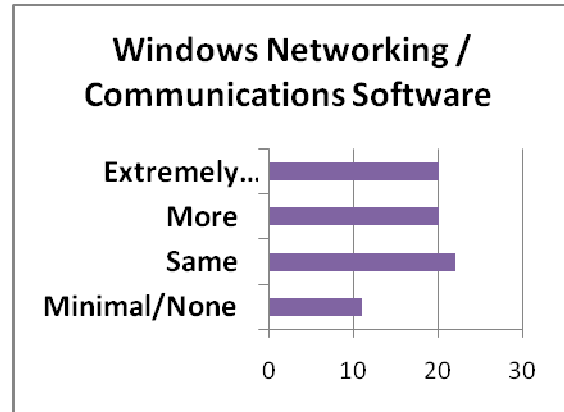


**Figure 3: Expected importance
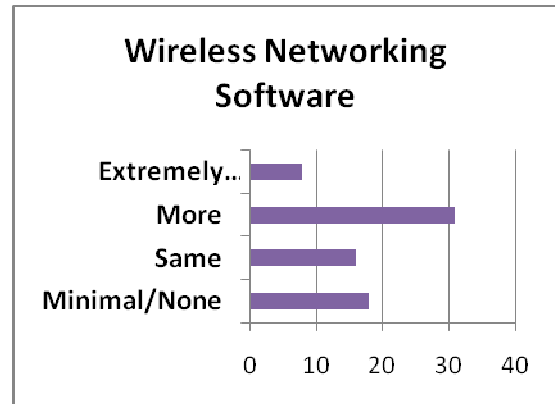of Windows Networking
and Communications Software**



**Figure 4: Expected importance
of Wireless Networking Software**

## 4.3. Databases

Leaders in the database grouping included Oracle, MS SQL, and My SQL (which placed third). IBM DB2, CA Ingress, FileMaker Pro and PostgresSQL trailed. Figures 5 and 6

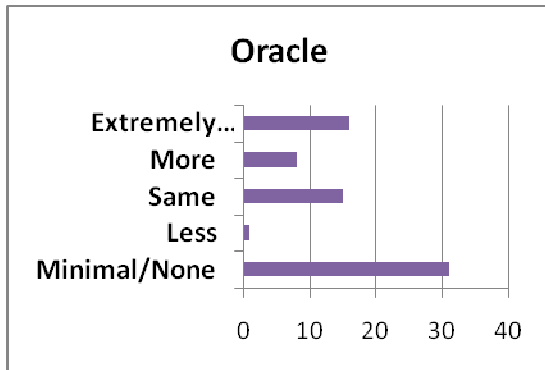detail the responses for the leaders while Appendix D details the responses of all databases queried.



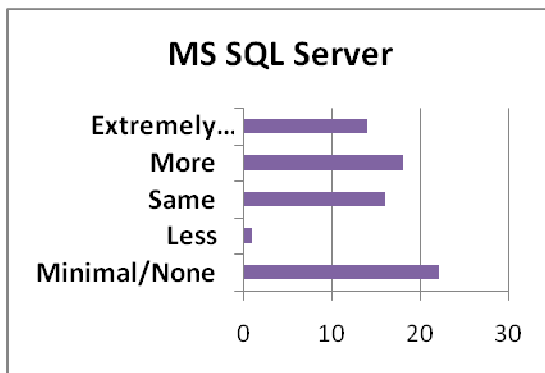**Figure 5: Expected importance of Oracle Databases**



**Figure 6: Expected importance of MS SQL Server**

### 4.4. Programming Languages

Fourteen different languages were queried. These languages included newer languages like XML as well as legacy languages like Fortran and Cobol. The languages did not have a clear dominant leader except for XML. XML was indicated to be "more important" as well as "extremely important" in the future. Figure 7 details the responses for XML.

In the area of web scripting languages, JavaScript was expected to maintain continued importance on the client side. However, a limitation of the survey is that we did not survey the importance of AJAX on the client side of web scripting.
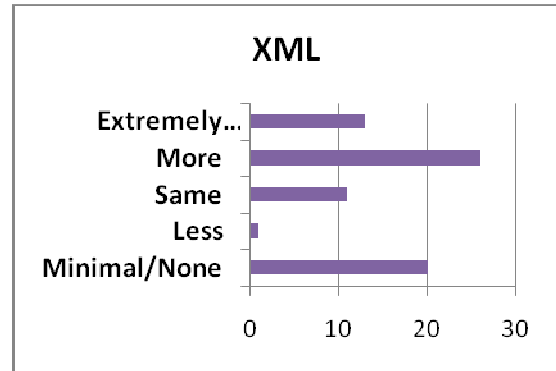


**Figure 7: Expected importance of XML**

On the server side, four scripting languages were investigated. Appendix E shows the relative importance of each and illustrates that no clear leader emerged, with Perl, PHP, and Python all remaining important. As expected, ASP (1.0) scripting is decreasing in importance as it was replaced with the .Net languages.

Other server side languages and more traditional languages such as C, C++, C#, and the .NET's were also surveyed. The importance level was lead by the .NET languages and ASP.Net (potentially a combination of C# and VB.Net) as well as C# and VB.Net. Java remained important as well as C++. Appendix F reports the survey results for programming languages

### 5. COMPARISON TO 2002/2003 SURVEY

This work parallels a 2002/2003 survey of IT workers. In that survey 225 surveys were emailed and 49 responses were obtained. As a reminder there were 79 respondents in the 2007 survey.

The following subsections and tables detail changes in importance level between the categories investigated. In all of the tables the importance ranking was calculated as follows: 5 for extremely important, 4 for more important, 3 for same, 2 for less, and 1 for none/minimal. A '- -' indicates that item was not surveyed in the 2002/2003 survey.

### 5.1. Operating Platforms

The Windows family remained at the same level of importance in the earlier survey. As shown in Table 4, the largest decrease was in the Palm Operating Platform.

| Product | 2007 Importance Rating | 2002/ 2003 Importance | Change |
|---|---|---|---|
| Windows | 3.9 | 3.9 | 0.0 |
| Linux/Unix | 2.6 | 2.9 | (0.3) |
| Palm | 1.7 | 2.2 | (0.5) |
| Windows CE | 1.7 | 1.9 | +0.2 |
| Mac OS | 1.5 | -- | -- |

**Table 4: Operating Platforms Rankings**

## 5.2.  Networking  &  Communications Software

In the networking and communications software category, no product increased in importance, with CISCO, Linux/Unix and Windows all receiving negative changes in importance ratings.

| Product | 2007 Importance Rating | 2002/ 2003 Importance | Change |
|---|---|---|---|
| Windows | 3.5 | 3.9 | (0.4) |
| Wireless | 3.2 | 3.2 | 0.0 |
| CISCO | 2.4 | 3.9 | (1.5) |
| Linux/Unix | 2.3 | 2.9 | (0.6) |
| Netware | 1.6 | -- | -- |
| Juniper | 1.5 | -- | -- |

**Table 5: Networking and Communication Software Rankings**

## 5.3. Databases

| Product | 2007 Importance Rating | 2002/ 2003 Importance | Change |
|---|---|---|---|
| MS SQL Server | 3.0 | 3.6 | (0.6) |
| Oracle | 2.7 | 2.9 | (0.2) |
| MySQL | 2.1 | 2.1 | 0.0 |
| IBM DB2 | 1.8 | 1.6 | +0.02 |
| PostgresSQL | 1.6 | 1.6 | 0.0 |
| Filemaker Pro | 1.4 | 1.3 | +0.1 |

| CA Ingress | 1.3 | 1.3 | 0.0 |

**Table 7: Database Rankings**

In the database category Microsoft SQL Server lead in the rankings, but dropped 0.6 in over its previous 2002/2003 ranking. Similarly Oracle took second in importance but decreased by 0.2 over its previous ranking. MySQL remained at the same level as the 2002/2003 survey.  The remainder of the changes are displayed in Table 7.

## 5.4, Programming Languages

| Product | 2007 Importance Rating | 2002/ 2003 Importance | Change |
|---|---|---|---|
| XML | 3.2 | 2.9 | +0.3 |
| VB.Net | 2.5 | 3.3 | (0.8) |
| Java | 2.4 | 2.4 | 0.0 |
| ASP.Net | 2.4 | -- | -- |
| ASP | 2.0 | 2.5 | (0.5) |
| C# | 2.0 | 1.6 | +0.4 |
| PHP | 1.9 | 1.5 | +0.3 |
| Perl | 1.8 | 1.8 | 0.0 |
| C++ | 1.7 | 2.0 | (0.3) |
| C | 1.6 | 1.8 | (0.2) |
| Python | 1.6 | 1.3 | +0.3 |
| Cobol | 1.5 | 1.6 | (0.1) |
| Fortran | 1.3 | 1.3 | 0.0 |

**Table 8: Programming Language Rankings**

Overall C#, XML, PHP, and increased in importance. VB.Net and ASP 1.0 (Script) decreased in importance as did C++, and C.

## 6. CONCLUSIONS

A review of the data from the survey indicates that the service area of the universities surveyed has a high concentration of Microsoft products.

As a result of the high usage of Microsoft products the survey results indicated that Windows, MS SQL Server, and the .Net programming languages all ranked high in importance and future importance.

In the operating platforms it was not surprising to see Palm platforms decreasing in importance, as cell phones and Blackberries

have developed their own operating systems. However, in the communications and networking software area, it was surprising to see the drop in CISCO importance while wireless networking and communication did not increase in importance.

MS SQL and Oracle lead the database packages while open source MySQL did not show any change since the 2002/2003 survey.

Finally in programming the importance of XML continued to increase. Again here the dominance of Microsoft products was evident in the popularity of C#, VB.Net and overall ASP.Net technologies. With web languages JavaScript remained important and PHP lead the group on server side scripting languages.

## 7. FUTURE RESEARCH AND REMARKS

Future research includes expanding the survey to additional employers outside the four institutions' service area. Our current survey results cannot necessarily be generalized beyond the participating institutions' geographic regions. This region is primarily on the east coast. Furthermore, a larger sample would certainly give us a clearer view of the data, and allow us to make more powerful statements.

A limitation of the survey is that at several of the institutions the mailing lists of participants were primarily alumni from those institutions. This could be a 'self reporting' problem in which alumni report the same knowledge sets they were taught.

Finally, we would like to report in the future how we adjusted our curriculum to better match the job market. In order to meet the industry expectations from the graduates, the academic environment should update the curriculum and skills of their faculty (Medlin et al., 2007). Furthermore, it touches on the question of what role should higher education play in IS skills. Should we move towards specific products and certifications, because of their high perceived value on graduates' resumes? Or do we focus on fundamental skills that are not product-specific and let organizations train graduates in the products that they use?

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**APPENDIX A**

**Sample Survey Page**

# Indicate what technologies you are currently using and your expected change in importance of the technologies

### Platforms

| Item | Currently Used | Expected Importance to your Job in 2 Years |
|---|---|---|
| Linux/Unix Family | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |
| Mac OS | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |
| Palm | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |
| Windows | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |
| Windows CE | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |

### Networking

| Item | Currently Used | Expected Importance to your Job in 2 Years |
|---|---|---|
| CISCO | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |
| Juniper | ○ Yes ○ No | ○ Minimal/None ⊙ Less ○ Same ○ More ○ Extremely Important |
| Linux/Unix | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ⊙ Extremely Important |
| Netware | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |
| Windows | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |
| Wireless | ○ Yes ○ No | ○ Minimal/None ○ Less ○ Same ○ More ○ Extremely Important |

**APPENDIX B**

**Survey Results for Platform Expected Importance**
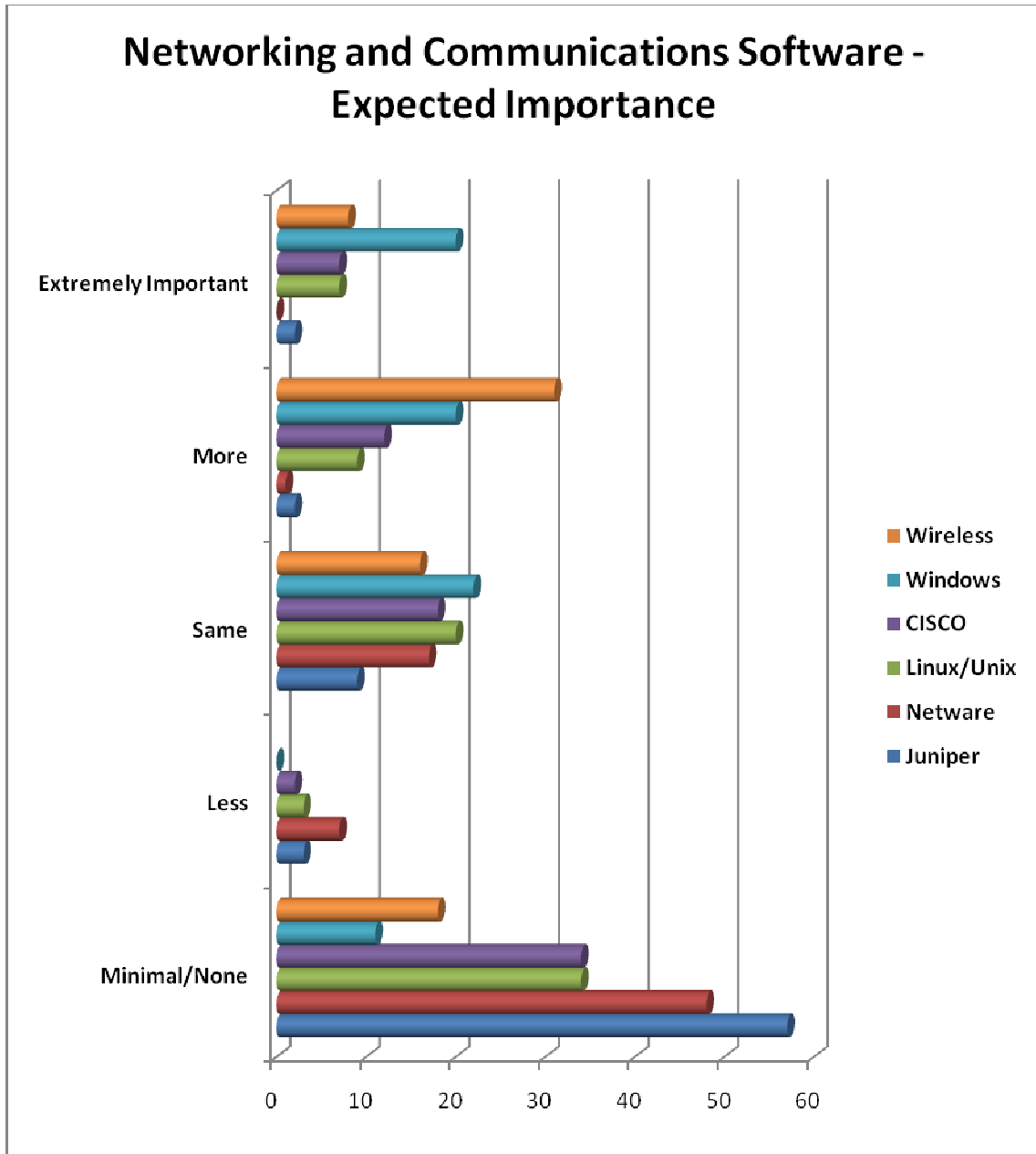
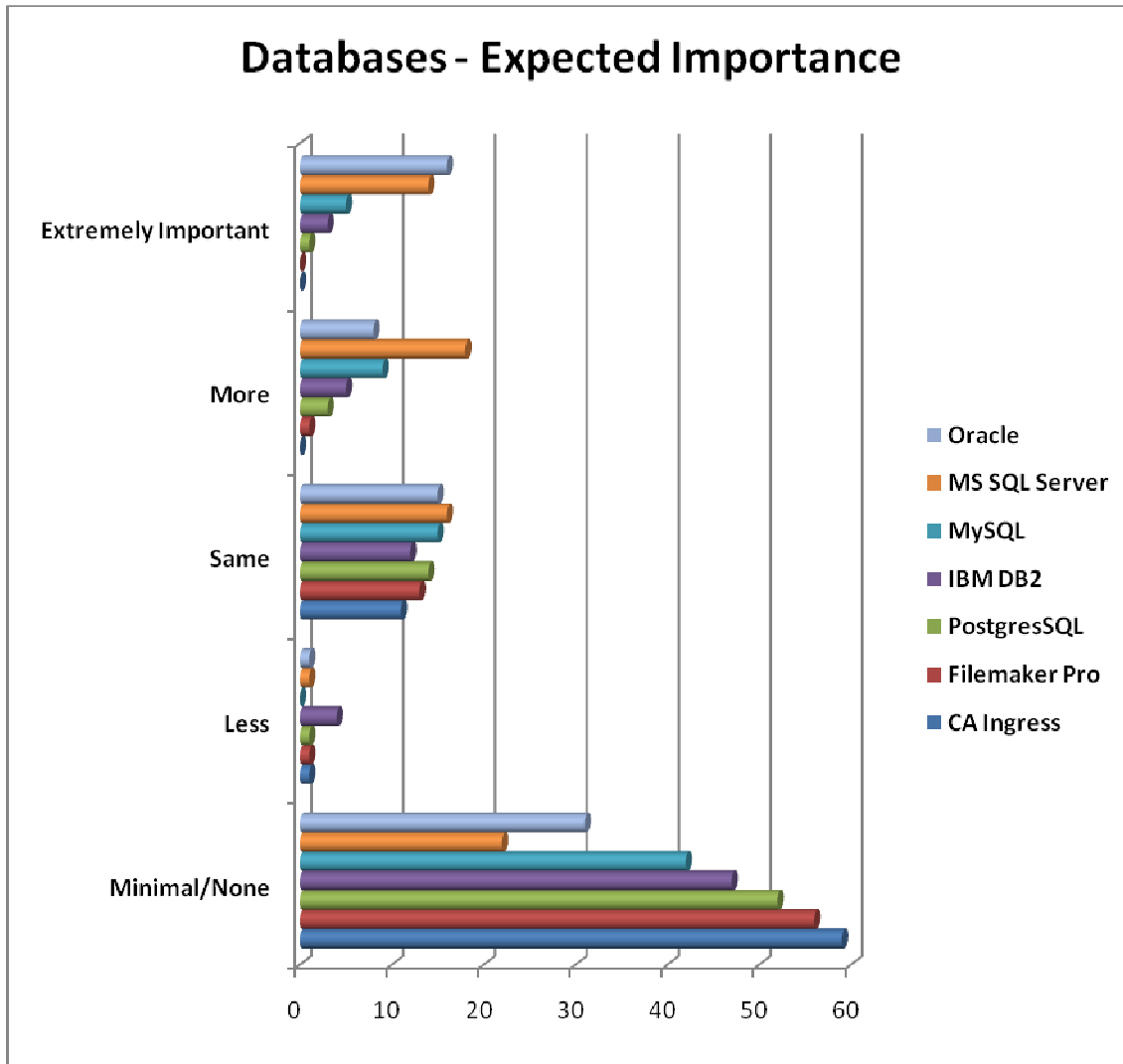

Platforms - Expected Importance
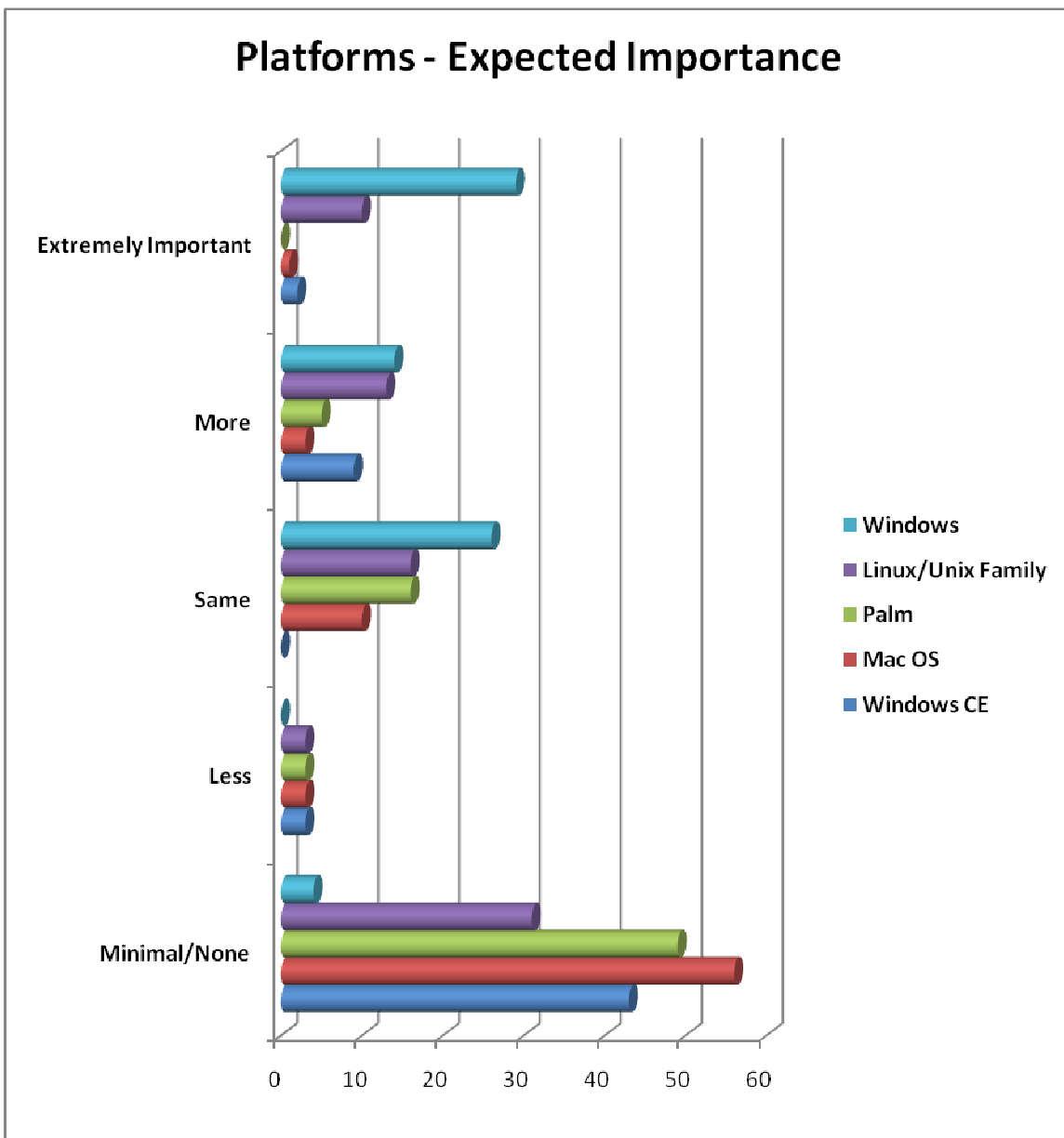
**APPENDIX C**

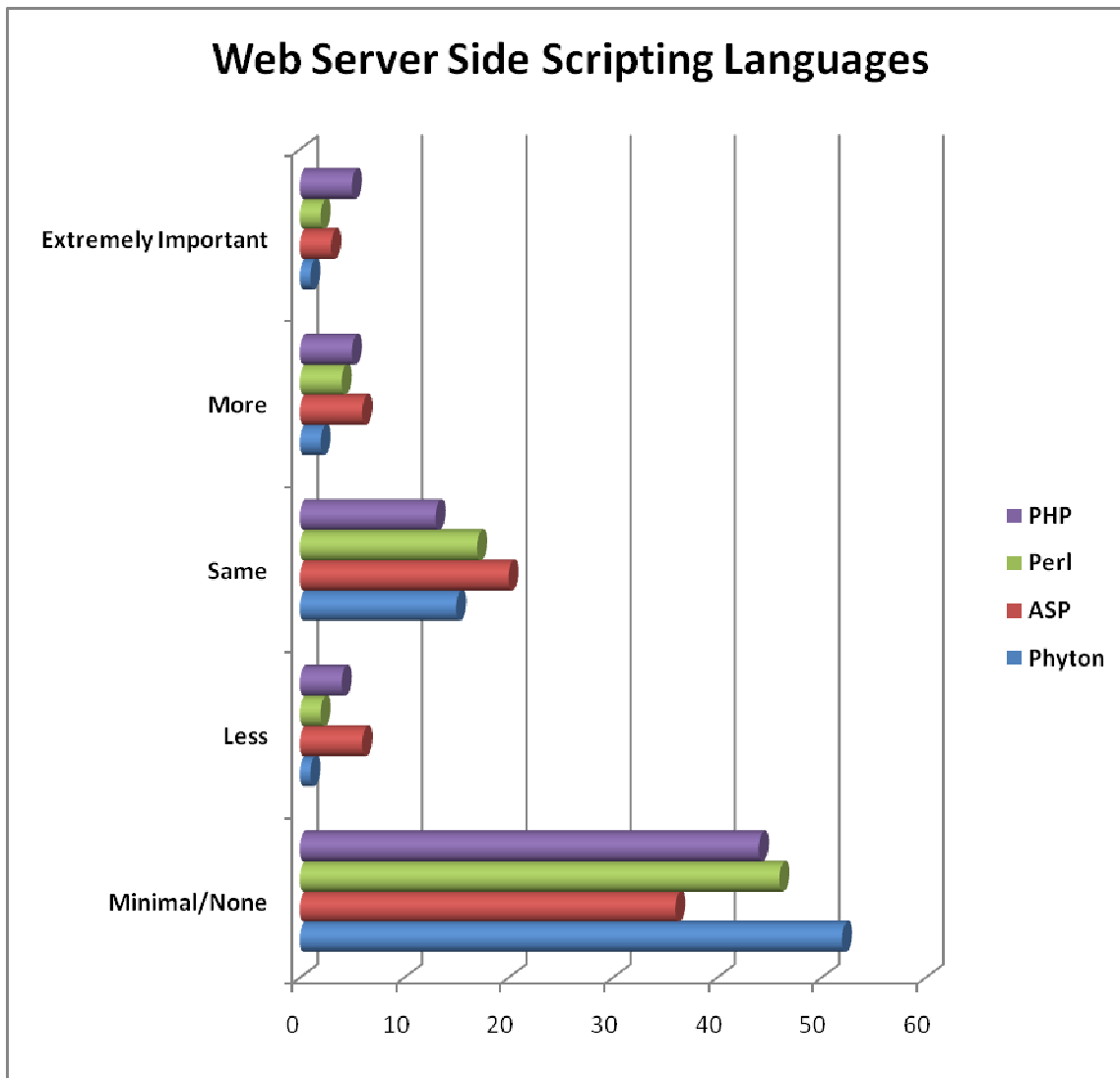**Survey Results for Networking and Communications Expected Importance**

**APPENDIX D**

**Survey Results for Database Expected Importance**

**APPENDIX E**

**Survey Results for**
**Web Server Side Scripting Languages Expected Importance**

**APPENDIX F**

**Survey Results for Programming Languages Expected Importance**