

# **Midwest Regional Business Requirements for Educational Services in Information Technology**

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# The Midwest Center for Information Technology

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[www.ccneb.edu](http://www.ccneb.edu)

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## **Metropolitan Community College (Nebraska)**

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## **North Dakota State College of Science**

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### **The Midwest Center for Information Technology**

is a virtual entity – a partnership of AIM Institute and ten community colleges in the four-state region of Iowa, Nebraska, North Dakota, and South Dakota working in collaboration with K-12 school districts, four-year colleges and universities, and employers to strengthen and expand the region's information technology workforce.



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# Introduction

In 1995 and 1999, the Applied Information Management (AIM) Institute completed major studies of **Greater Omaha Business Requirements for Educational Services in Information Technology**. These studies were well received by both the business and academic communities, as presenting an accurate representation of Greater Omaha business requirements for Information Technology (IT) education.

The studies documented areas of greatest demand by the business community for IT educational services and noted areas where the academic community could strengthen its offerings. The studies also estimated the size of corporate educational budgets and Information Technology employment. The titles and results of these studies are listed below and are available at the AIM Institute, 118 South 19<sup>th</sup> Street, Omaha, NE 68102 or on the AIM website at [www.aiminstitute.org](http://www.aiminstitute.org).

1. Greater Omaha Business Requirements for Educational Services in Information Technology (1995)
2. A Vision for Information Technology and Engineering Education (1995)
3. Greater Omaha Business Requirements for Educational Services in Information Technology – Update for 1999
4. Progress and Change in Information Technology (1999)

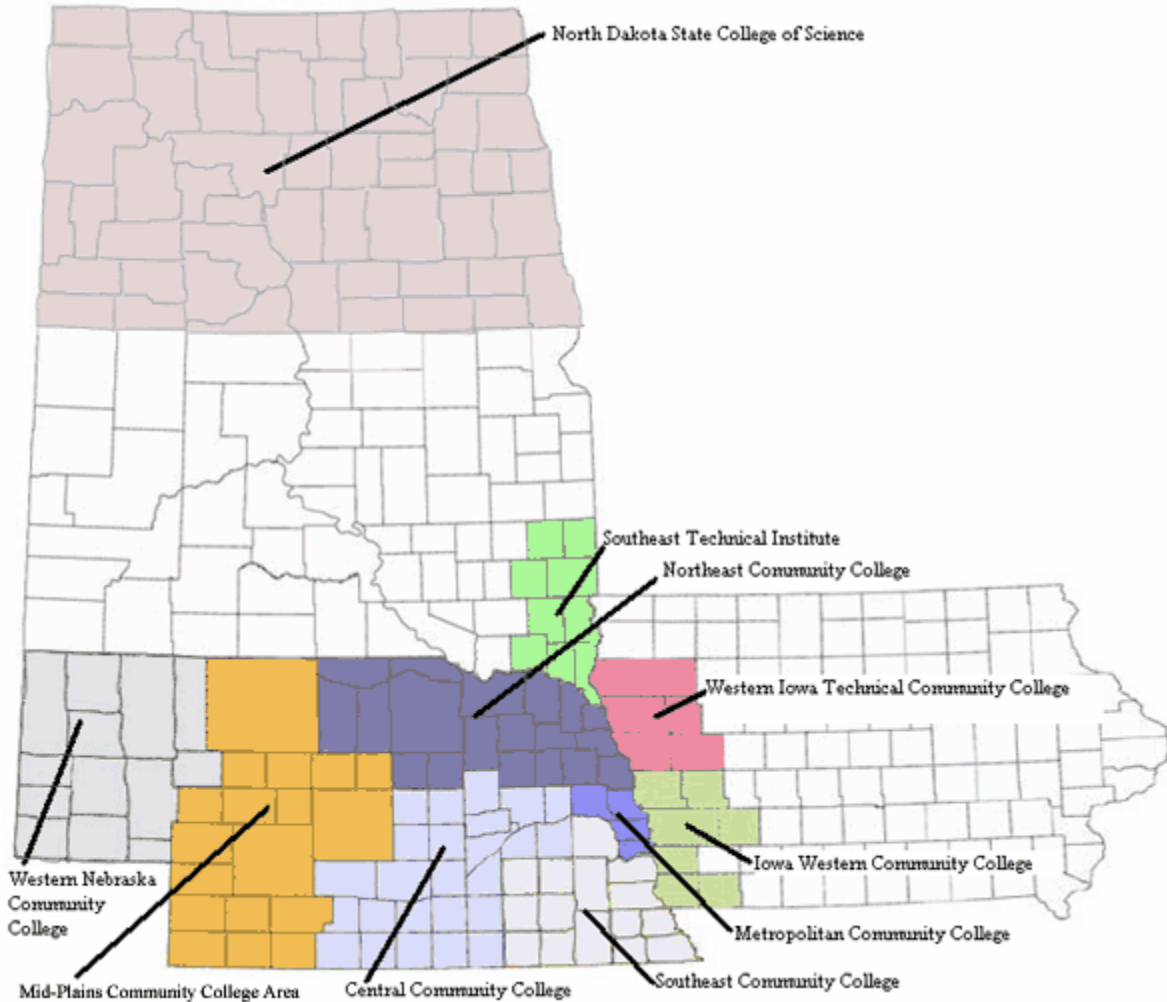
In 2002 under the auspices of a National Science Foundation (NSF) grant and in partnership with ten Midwest community colleges (Appendix A), AIM conducted a similar Midwest Regional Study for Nebraska and parts of Iowa, South Dakota and North Dakota. Each of the ten partnering community colleges circulated a questionnaire to businesses in their service area (Figure 1). Demographics of each area served, showing labor force and numbers of employers, is shown in Figure 1. There were a total of 124 respondents, of which over 95% were outside the Omaha Metropolitan Area. These results provided insight into Business Requirements for Educational Services in Information Technology by firms in non-major metropolitan areas in these four states. The findings should be instructive to community colleges and postsecondary institutions as they evaluate and develop Information Technology curriculums. The findings will also be helpful in student recruiting, faculty selection and training, community outreach programs, and structuring articulation agreements between IT programs at area colleges and universities.

Finally, even though the economic climate of mid-2002 is much less robust than that of the technology boom of 1999, comparisons between urban (results from the 1999 Greater Omaha Study) and more rural business environments will prove instructive. These findings are reported in a separate study, "Rural/Urban Variations in Business Requirements for Educational Services in Information Technology."

# Introduction

FIGURE I

## Midwest Center for Information Technology Four State Region – North Dakota, South Dakota, Nebraska and Iowa



### Midwestern Regional Labor Statistics

Community College	Labor Force (May 2002)	Number of Employers* (June 2002)	Number of Employers* 1-99 Employees (June 2002)	Number of Employers* 100+ Employees (June 2002)
Central Community College	168,538	16,900	16,029	209
Iowa Western Community College	91,012	7,804	7,375	107
Metropolitan Community College	358,597	28,218	26,934	290
Mid-Plains Community College Area	50,096	6,582	6,196	35
North Dakota State College of Science	340,820	38,930	36,461	544
Northeast Community College	88,212	9,279	8,804	75
Southeast Community College	244,444	21,033	19,182	356
Southeast Technical Institute	152,019	22,670	12,971	260
Western Iowa Technical Community College	94,083	9,054	8,468	137
Western Nebraska Community College	48,972	5,827	5,582	43
<b>Total Midwestern Regional</b>	<b>1,636,793</b>	<b>166,297</b>	<b>148,002</b>	<b>2,056</b>

Sources: DirectoriesUSA.com  
U.S. Department of Labor, Bureau of Labor Statistics

\* Not all employers recorded their employee size.

# Executive Summary

## A. **EMPLOYMENT TRENDS**

A survey to document business requirements for Midwest firms was completed in partnership with the National Science Foundation and the partners in the Midwest Center for Information Technology (IT). The study included 124 firms in the Midwest with a total of 32,206 employees.

Information Technology employees totaled 1,873 or 5.8% of all employees in responding firms. Other significant numbers include:

- 11.2% or 3,618 of all employees from responding firms are currently taking academic courses.
- 18.9% of employees taking academic courses are in tuition reimbursement programs.
- Total training budgets for the 73 firms reporting these data were only \$4.5 million and are projected to exceed \$6.1 million in five years.
- For the firms reporting these data, the per-employee training budget is:

<b>Training Budget - Per Employee</b>		
	<b><u>2002</u></b>	<b><u>Five Years</u></b>
All Employees	\$ 256	\$ 312
IT Employees	\$1,345	\$1,367

The percentage of employees with sub-baccalaureate degrees was 40.1%. Many firms would like to see their employees gain more advanced degrees. These employees create a large potential market for future additional academic courses/degrees programs, and create a demand for better articulation agreements to facilitate advanced educational opportunities.

<b>Degree Level of IT Employees</b>		
	<b><u>2002</u></b>	<b><u>Five Years</u></b>
Sub-Baccalaureate	40.1%	30.4%
Baccalaureate	50.2%	53.3%
Graduate	9.7%	16.3%

# Executive Summary

Firms ranked the importance of nine Academic Disciplines and 48 Applied Areas within those Academic Disciplines. The following shows that the top ranked **Applied Areas** within each **Academic Discipline**.

## B. **Academic Disciplines and Most Important Applied Areas**

### **Electronic Engineering**

#### **Telecommunications**

- Protocols, ATM, TCP/IP, Frame Relay, ADSL
- Telephony
- Fiber Optics

#### **Systems Integration**

- Software/Hardware Configuration
- LAN/WAN
- Quality Assurance
- Standards/Documentation

#### **Computer Engineering & Systems**

- Architectures/Platforms

#### **Systems Development & Business Integration**

- Methodology
- Data Warehousing
- Client/Server
- Design/Programming
- Decision Support

#### **Technology Management**

- Project Management

#### **E-commerce**

- Development Technologies
- Security

#### **Networking (LAN/WAN/IP)**

- Protocols - Open & Proprietary
- Integration
- Convergence
- Servers, Bridges, Routers and Hubs
- Security Encryption
- Continuity, Interruption & Recovery

Other significant findings include:

- Expenditures for training and education will increase faster (35.1%) than employment (9.2%).

## Executive Summary

- Firms will increase internal training budgets and tuition budgets relatively faster than externally provided workshops and seminars, and certificates programs. Tuition reimbursement programs will grow the fastest over the next five years (116.0%) but this program is only 6.9% of the training budget.
- IT professional positions will grow (11.5%) slightly faster than all employees (9.2%).
- The Academic Disciplines and Applied Areas ranked most important demonstrate the dramatic move to the network E-commerce environment that businesses find themselves in today. Those changes create a demand for the associated areas of security, development and management issues.

### C. **Recommendations**

#### 1. Business/Academic Partnerships

Business has the opportunity to directly influence academic programs by:

- Creating partnerships between business and academia for joint appointments of highly qualified individuals to bring top quality talent to their firm and their collegiate partner.
- Further defining specific needs in the new Academic Disciplines and Applied Areas listed as most important in this study. This work should be done in close consultation between the business and the academic community.
- Working with colleges and universities to develop creative programs that attract more students into all Information Technology programs. The object is to close the gap between the growth in demand of IT professionals and the number of new graduates.
- Continuing educational opportunities for IT professionals, particularly in rural areas, is essential for continued growth of the firm and region. Community colleges have the opportunity, charter and responsibility to help meet this need.
- This recommendation is closely aligned with the requirements of the National Science Foundation's Midwest Center for Information Technology grant. It is also good business for employers and academics alike.

#### 2. Education of the IT Professional

Continued focus on the IT career pipeline is essential. Educational requirements for IT employees will be continued through their career. Articulation agreements that allow seamless progression to higher degrees is essential. Other barriers to further education associated with distance, incomplete offerings at a site, obsolete offerings, poor articulation, etc. must be diminished to meet future workforce requirements.

## Executive Summary

### 3. Faculty

The array of topics required in the future may exceed the ability of any educational institution to deliver. An adequately prepared faculty and relevant curricula will require:

- Robust faculty training opportunities.
- Strategies to attract experienced full-time and adjunct faculty.
- The ability to add and drop classes more rapidly than historically possible.
- Increased academic partnerships and curriculum/faculty sharing across the academic community.

### 4. Shifting Demand

The Academic Disciplines of Telecommunications, Networking and E-commerce will be the major technology drivers in the near future. Of the 22 highest ranked Applied Areas, 11 fell within these Academic Disciplines. Focus by postsecondary institutions on courses and programs in these areas will be key to maintaining growth and relevancy of the academic programs. Many of the courses and academic disciplines may be new to traditional Information Technology programs at community colleges.

### 5. Interdisciplinary Focus

Integration is a major consideration. The top four Academic Disciplines were:

- Networking (LAN/WAN/IP)
- Systems Integration
- Telecommunications
- Systems Development & Business Integration

More effective interdisciplinary efforts across different colleges, departments and programs within a single institution will have high yields.

E-commerce is the most interdisciplinary discipline yet. It includes Computer, Telecommunications, Networking, Audio, Video, Graphics, Business Writing, Foreign Languages, Law, Finance, Marketing, Public Policy, etc.

Also, as Information Technologies become more strategic, systems design will become more comprehensive, leading to an integration of diverse functions across the enterprise.

### 6. E-commerce

There is no event in the history of business and commerce that has so quickly and profoundly changed business practices and outlook as E-commerce. This is true across the nation for all sizes of firms in all regions. E-commerce is a “developing event” that will profoundly affect business practices, products and services, markets, etc. It has been one of the fastest growing areas of IT employment in recent years, and this trend will continue. 8% of the Midwestern IT professionals now work in E-commerce and they are expected to exceed 9% in five years. E-commerce courses and programs must be focused (including development technologies and security), interdisciplinary, responsive to change and relevant.

## Background

From an economic development perspective, it is absolutely critical that Midwest businesses and entrepreneurs have the technical access and knowledge to use Information Technology to remain competitive and expand market opportunities. It is the current and future businesses that will provide the employment opportunities and become the engine for economic growth. These businesses, from agriculture to zoological endeavors, must remain competitive. The emerging, networked E-world creates enormous opportunities for Midwest businesses to grow. These same conditions create an opposite risk if they lose market shares to new cyber competitors.

Growth in the *intellectual infrastructure* must be robust and world class at both the community level and the state level. All segments of the society – private sector, government and education – must have a perspective that fosters opportunities for Nebraska employers to gain the required knowledge and strategic thinking.

The *technical infrastructure* also must grow in capacity as rapidly as market requirements expand and competitive regions develop. These intellectual and technical capacities are being stretched, particularly in rural areas. Information Technologies (IT) are increasingly becoming the platform on which business and commerce depend. For many Midwestern firms, Information Technologies:

- Are moving from operationally important to strategically essential.
- Are the electronic platform for communication and business transactions across the firm and industry, reaching out to customers and back to suppliers.
- Are the basis for an increasing array of unique technology-based goods and services.
- Are giving access to national and global markets.
- Are controlling processes and systems.

Essential ingredients to a productive IT environment include both:

- a robust technical infrastructure, plus
- an experienced, well educated and adequate labor pool.

Documenting some of this progress nationally: “Rural households, which historically trailed those in central cities and urban areas, are showing significant gains in Internet access. The gap between households in rural areas and household nationwide that access the Internet has recently narrowed. There was a 4.0 percent point difference in 1998, narrowing to a 2.6 point difference in 2000.”<sup>1</sup>

“These developments have not escaped the attention of Nebraska business owners and operators. Information Technologies are widely used by Nebraska business. In this survey of 382 rural Nebraska business owners and manager, computers and other information technologies are being used extensively for a variety of business operations.”<sup>2</sup>

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<sup>1</sup> Falling Through the Net; Toward Digital Inclusions; U.S. Dept. of Commerce, Economics & Statistics Administration, National Telecommunications and Information Division; October, 2000.

<sup>2</sup> Nebraska Business Use of Information Technology; Sweeney, Robert E.; Applied Information Management Institute and Center for Applied Rural Innovation – University of Nebraska; 2000 online edition; Omaha, NE; [www.aiminstitute.org](http://www.aiminstitute.org).

# Background

## Technology Infrastructure Adequate Technology Resources – by Community Size

**Question:** *How adequate are the resources available to your business in the following areas?*

Technology	Size of Community					
	Less than 5,000		5,000-19,000		20,000 or more	
	<i>Somewhat</i>	<i>Very</i>	<i>Somewhat</i>	<i>Very</i>	<i>Somewhat</i>	<i>Very</i>
Technology infrastructure	22%	9%	27%	13%	26%	14%
Bandwidth/Internet access speed	19%	7%	31%	12%	28%	12%
Web development professionals	29%	9%	32%	17%	33%	19%
Internet access providers	29%	20%	38%	34%	31%	37%
Electronic banking availability	23%	15%	31%	23%	32%	28%
Educational opportunities about IT	28%	7%	40%	14%	35%	21%
Hardware/software suppliers	35%	15%	40%	20%	34%	30%
Infrastructure support personnel	28%	7%	36%	9%	25%	20%

“These data show that the most significant difference exists when comparing the smallest communities (less than 5,000) with larger communities. There appears to be a very little difference between communities of 5,000–19,999 and those over 20,000 in population when comparing either the intellectual or technical IT infrastructure of the communities.”<sup>3</sup>

Unfortunately, capacity and availability of core communications technologies are largely outside the control of individual businesses. Growth in this infrastructure rests with various providers and will be influenced by the unique requirements to provide services to low-density population areas, numerous regulatory issues, and various policy considerations.

The intellectual infrastructure, however, can be influenced somewhat by training budgets and programs and robust support from area academic institutions. The Midwest labor market has many favorable attributes including its work ethic, general education levels, etc. A tight labor supply, however, is a persistent challenge in some areas. Internal growth rates of existing companies create a demand for IT professionals that exceeds their supply.

While a softer economy in 2001 and 2002 have eased these concerns somewhat, long-term demand for IT professionals will continue to be robust for some time. This internal demand is driven by the normal business growth and increased reliance on IT to remain competitive or gain competitive advantage. In addition, there is an increasing percent of all jobs within firms that require IT training to perform expected job functions.

A primary source of new IT professionals will continue to be regional colleges and universities. In addition to the problem of a tight supply of IT professionals, this study will also document that courses and curriculums from local institutions frequently do not include the content desired by many area firms. Still, substantial progress has been made in recent years. The rapid change in technologies and their rapid adoption by businesses of all sizes suggest continued robust demand for relevant academic

<sup>3</sup> Ibid

# Background

curriculums. Employers' needs - driven by the emerging electronic marketplace - have grown more rapidly than most postsecondary institutions have responded.

To help bring a sharper focus on business needs, the Applied Information Management (AIM) Institute in cooperation with ten Midwestern community colleges (Appendix A) and the National Science Foundation has completed an extensive study of Midwestern business IT requirements. The following summarizes the findings of this study. The results are designed to provide an informed and documented statement of those business requirements to academic institutions. This report will also be instructive in helping area businesses evaluate their operations and focus their expectations from local educational providers.

## STUDY METHODOLOGY

This study is based on a questionnaire designed to document Midwestern firms' present and future requirements for employment, training and curriculum. The questionnaire is very similar to previous surveys completed in 1995 and 1999 for Greater Omaha firms. The more rural focus of this study will provide an excellent contrast between the needs of the more rural employers' firms compared to their urban counterparts.

The results likely understate the number of IT professionals because most firms reported only their computer center employees as IT professionals. This reporting may not include IT professionals doing sales, training, marketing, working on the factory floor or other departmental IT professionals. The results also understate training budgets. Only 73 of the 124 survey respondents provided these data and many stated their reported training budgets were incomplete.

Respondents were asked to rank specific Academic Disciplines, Applied Areas, Technology Areas and Vendor Certifications. In addition, they were asked to rank how well area universities were meeting their needs in each Applied Area. Values shown in this report are weighted averages based upon:

$$\frac{\sum \text{Number of IT Professionals Employed by Respondents Who Ranked the Applied Area} \times \text{Rank}}{\sum \text{Number of IT Professionals Employed by Respondents Who Ranked the Applied Areas}}$$

The same methodology was used to rank Academic Discipline, Technology Areas, Vendor Certifications, and how well college and universities meet needs.

Ranking scale: 1=Most Important, 4=Least Important, with the midpoint value on such a scale=2.50.

Survey responses were received from 124 employers with a total of over 32,200 employees. Respondents included 46 employers with employment of 100 or more, and 78 small firms with fewer than 100 employees. Appendix B includes the list of respondents. Appendix C shows the composite averages and totals by size of firm for each question.

# Findings

## A. **EMPLOYMENT AND TRAINING BUDGETS**

### 1. **Corporate Employment**

Survey forms were completed by 124 firms including 46 with Midwest employment of 100 or more, and 78 small firms with employment less than 100.

Survey results represent firms with 32,206 employees.

During the next five years, employment is expected to approach 35,200 a 9.2% growth.

3,618 or 11.2% of present employees are currently taking academic courses for credit.

18.9% of these employees were on company tuition reimbursement programs.

Firms believed that over 3,208 additional employees should be taking academic credit courses.

### 2. **Corporate Training Budgets**

73 of the respondents reported their training budgets. The total training budgets for the firms reporting these data were \$4,522,371 or \$256 per employee.

These training budgets are projected to increase over 35.1% to over \$6,110,000 in five years, or \$312 per employee. Budget projections over the next five years for tuition and cost of college courses are expected to more than double.

For firms providing detail training budget expenditures, 25.6% of that budget is used for internally-provided training with the balance going to external seminars and workshops (36.1%), vendor certification programs (27.1%), college tuition (6.9%), and other (4.4%).

In five years, internal training budgets will increase to 29.7% of the total training budget while seminars and workshops decrease to 31.8%, certifications slip less than one percentage point to 26.3%, tuition for college courses increase to 9.8%, and other drops to 2.4%.

### 3. **Small Firms**

While there were 78 firms with less than 100 employees, only 48 firms reported training budgets. These training budgets per employee for the 48 small firms reporting this data are somewhat more than their larger counterparts at \$323. Total employment for the firms with 99 or less employees, is expected to grow 22.5% while training budgets grow 31.4%. Therefore, the average training budget, per employee, increases to \$352 in five years.

5.2% of the employees in the smaller firms are enrolled in academic credit courses somewhat less than the 11.7% for the large firms.

### 4. **IT Employment - All Firms**

IT employees compose 5.8% of all employees.

The five-year growth in the number of IT employees is projected at 11.5% compared to 9.2% for all employees.

# Findings

10.0% of all IT employees are taking academic credit courses. This is slightly less than the rate of 11.2% for all employees.

31.6% of these IT employees were on college tuition reimbursement programs.

## 5. IT Training Budgets - All Firms

Total IT training budgets for 57 of the 124 firms reporting these data were \$1,788,063. Five-year IT training budgets are projected at over \$2,015,000, an increase of 12.7%.

For firms reporting the data, IT training averaged \$1,345 per employee and is projected to increase slightly to nearly \$1,367 in five years. While IT employees account for 5.8% of all employees, IT accounts for 39.5% of the training budgets. That is expected to decline slightly to 33.0% in five years.

## 6. Small Firms

IT employees account for 10.6% of all employees in the smaller firms – nearly twice the 5.4% for large firms.

18.7% of the total training budget for these small firms goes to IT training.

For the 27 small firms reporting the data, IT training expenditures average \$738 and are expected to decline slightly in 5 years to \$713.

## B. **ACADEMIC DISCIPLINES**

Respondents were asked to rank specific Academic Disciplines. They were also asked to report the number of IT employees in each discipline and project their requirements five years hence. Finally, respondents were asked to estimate what percent of their IT workforce had educational background at the sub-baccalaureate, baccalaureate or graduate level.

In this survey the following nine academic disciplines were ranked:

- Electronic Engineering
- Telecommunications
- Systems Integration
- Computer Engineering and Systems
- Systems Development and Business Integration
- Technology Management
- Technology Marketing
- E-commerce
- Networking (LAN/WAN/IP)

Many of these disciplines will appear in college catalogs across the nation. Some, however, reflect changing business needs that have not yet found their way into academic programs. *Systems Integration* and *E-commerce* are examples.

# Findings

## 1. Electronic Engineering

In colleges and universities across the country, the intellectual roots for IT curriculums are frequently in three Colleges:

- Engineering
- Business Administration
- Liberal Arts (often the Math Department)

In the Midwest, most programs have a strong business or liberal arts heritage. The survey results rank many technical disciplines which may not be available in each community. *Electronic Engineering* accounted for less than 5.0% of respondents' IT employees. Employers ranked *Electronic Engineering* as the second least important Academic Discipline.

Electronic Engineering			
	Small	Large	<u>TOTAL</u>
RANK	2.84	2.55	2.59

## 2. Telecommunications

The *Telecommunications* discipline included protocols, wireless, telephony, fiber optics and other areas. Networking, discussed below, focuses on LAN, WAN, Internet Protocols, Integration, Server Security, Etc.

Much of the Midwest business community has a strong and growing telecommunications requirement with nearly 7.0% of the IT workforce dedicated to this discipline. All respondents ranked *Telecommunications* as the third most important Academic Discipline. Local industries with global markets face challenges of a lack of adequate telecommunications and the associated intellectual infrastructure to capitalize on strong long term market potential. The virtual absence of strong programs in telecommunications suggests that college and university courses and programs have significantly lagged behind regional demands.

Large and small firms both ranked *Telecommunications* high. Total employment is expected to grow to 9.6% of the IT professionals in 5 years. A strong set of *Telecommunications* courses is required to round out the academic programs of many IT majors.

Telecommunications			
	Small	Large	<u>TOTAL</u>
RANK	2.29	1.63	1.72

*Rank 1 = Most Important 4 = Least Important*

# Findings

## 3. Systems Integration

The much-discussed convergence of IT disciplines such as computers, video, telecommunications, wireless, TV, performing arts, web graphics & textual presentation, etc., is well documented. Building and supporting the networked platform used by most firms to conduct business requires significant *System Integration* skills. In addition, the integration of electronic devices into structures, machines, and processes is accelerating.

The integration of converging technologies takes place at the physical and application levels:

1. The hardware platforms including the integration into physical structures and devices.
2. Applications frequently transcend all levels of activity within and across the firm plus providing access to its suppliers and customers.

The survey's definition of *Systems Integration* captures the essence of that integration stated above. This activity consumes increasing amounts of corporate energy. Concepts are taught in various courses. However, an organized academic discipline does not yet exist in most regional postsecondary institutions. Increasing momentum towards interdisciplinary curriculums at post-secondary institutions would encourage greater *Systems Integration* focus.

*Systems Integration* was the second highest ranked Academic Discipline. It was ranked as more important by large firms than small firms and accounts for over 12.0% of all IT employees.

<b>Systems Integration</b>			
	<b>Small</b>	<b>Large</b>	<b><u>TOTAL</u></b>
<b>RANK</b>	2.00	1.29	1.39
<i>Rank 1 = Most Important 4 = Least Important</i>			

## 4. Computer Engineering & Systems

The importance of *Computer Engineering & Systems* areas ranked in the middle of all Academic Disciplines. Historically, many topics in this discipline have had a mainframe focus. About 10% of the IT professionals were reported working in this discipline.

<b>Computer Engineering &amp; Systems</b>			
	<b>Small</b>	<b>Large</b>	<b><u>TOTAL</u></b>
<b>RANK</b>	2.16	1.90	1.93
<i>Rank 1 = Most Important 4 = Least Important</i>			

# Findings

## 5. Systems Development and Business Integration

Applications that transcend all levels of business activity within a firm or industry are captured in the Academic Discipline of *Systems Development and Business Integration*. Historically, many of the area colleges and universities have had relatively strong courses and programs around systems and development topics. These programs are increasingly addressing broader issues associated with the changing platforms and business requirements and their impact on systems development.

*Systems Development and Business Integration* ranked fourth among all academic disciplines. Smaller firms ranked it somewhat lower, however.

<b>Systems Development and Business Integration</b>			
	<b>Small</b>	<b>Large</b>	<b><u>TOTAL</u></b>
<b>RANK</b>	2.28	1.65	1.74
<i>Rank 1 = Most Important 4 = Least Important</i>			

It is the largest current and future component of the IT employment pool, accounting for over 20% of all IT jobs, currently. While remaining the largest pool of future employees, *Systems Development and Business Integration* employees will account for only 17.4% of the IT workforce in five years as all other disciplines are projected to grow more rapidly.

## 6. Technology Management

*Technology Management*, ranked fifth overall as an academic discipline, represents a growth discipline in which college and university programs continue to lag behind business demand. Small firms ranked *Technology Management* as their second most important Academic Discipline.

<b>Technology Management</b>			
	<b>Small</b>	<b>Large</b>	<b><u>TOTAL</u></b>
<b>RANK</b>	1.97	1.81	1.83
<i>Rank 1 = Most Important 4 = Least Important</i>			

*Technology Management* accounted for 10.3% of all IT employment, and will decline slightly to 9.7% in five years as a percentage of the IT workforce, even though the actual number of such employees is expected to increase slightly from present levels.

# Findings

## 7. Technical Marketing

*Technical Marketing* professionals accounted for 4.6% of IT employment. No program that focuses on *Technical Marketing* exists in the area. The focus of a *Technical Marketing* Discipline would include the technological knowledge and understanding of how to market technology-based products and services.

Technical Marketing			
	Small	Large	<u>TOTAL</u>
RANK	2.13	3.12	2.98

Rank 1 = Most Important 4 = Least Important

## 8. E-commerce

*E-commerce* has "exploded" onto the business and technology landscapes. *E-commerce* represents an entirely new discipline and skill set in IT. It also will affect public policy, the relevance of geography, law, marketing and numerous other business and policy issues.

In this study, *E-commerce* is presented as an Academic Discipline with five Applied Areas. It scored as the seventh most important Academic Discipline with over 8.0 % of the IT workforce. In five years, firms projected that over 9.0% of the IT professionals will work in *E-commerce*.

E-Commerce			
	Small	Large	<u>TOTAL</u>
RANK	2.17	1.92	1.95

Rank 1 = Most Important 4 = Least Important

# Findings

## 9. Networking

*Networking* was the highest ranked Academic Discipline for both large and small firms. Five different Applied Areas, or nearly one-third of all highly ranked Applied Areas came from *Networking*. Nearly every firm with multiple computers and an Internet strategy requires these skills. Networking is one of the fastest growing IT disciplines for large and small firms alike.

<b>Networking</b>			
	<b>Small</b>	<b>Large</b>	<b><u>TOTAL</u></b>
<b>RANK</b>	1.71	1.17	1.24
<i>Rank 1 = Most Important 4 = Least Important</i>			

In recent years a dramatic change has occurred in business and industry. The explosion of the World Wide Web and communication technologies is leading to a restructuring of the business enterprise. This table clearly documents that impact of the “wired world” on IT employment in Midwestern firms.

<b>Wired World Growing Rapidly All Firms</b>			
<b>RANK</b>	<b>Academic Disciplines</b>	<b>Percent of IT Employees</b>	
		<b>2002</b>	<b>In 5 Years</b>
1.72	Telecommunications	9.4%	9.7%
1.24	Networking	11.7%	12.4%
1.95	E-commerce	8.0%	9.1%
	<b>Total</b>	<b>29.1%</b>	<b>31.2%</b>
<i>Rank 1 = Most Important 4 = Least Important</i>			

# Findings

## 10. Degree Levels

For all firms, the current number of IT professionals with a sub-baccalaureate degree is over 40%, and is projected to decline to 30% in five years. These data suggest firms expect employees to make a logical progression in academic achievement while on the job. It also suggests these employers will be looking for more new employees with baccalaureate degrees.

The data also implies the need for good articulation agreements between two and four year institutions to facilitate these career development requirements. It also argues for good distance educational opportunities for employees whose work is not near a college campus.

Percent of IT Employees by Firm Size			
	Small	Large	<u>ALL FIRMS</u>
<b>Sub-Baccalaureate</b>	54.4%	34.0%	40.1%
<b>Baccalaureate</b>	29.9%	59.0%	50.2%
<b>Graduate</b>	15.8%	7.1%	9.7%
<b>In 5 Years</b>			
<b>Sub-Baccalaureate</b>	34.6%	27.5%	30.4%
<b>Baccalaureate</b>	38.2%	63.1%	53.3%
<b>Graduate</b>	27.1%	9.3%	16.3%

Employees with sub-baccalaureate degrees make a large potential market for additional academic courses/degree programs. Numerically, these employees are highly concentrated in larger firms that frequently have college tuition reimbursement programs.

## C. APPLIED AREAS AND NEEDS MET BY AREA COLLEGES & UNIVERSITIES

Respondents were asked to rank specific *Applied Areas* within each Academic Discipline. In addition, they were asked to rank how well area colleges and universities were meeting their needs in each *Applied Area*. Appendix C shows ranking for all 48 *Applied Areas* for all 124 firms plus the 78 small employers and the 46 larger employers.

# Findings

## 1. Needs Met by Area Colleges and Universities

The average score for all *Applied Areas* was 2.09. Meanwhile, the average all firms score for "needs met by area colleges and universities" was 2.71. This average difference of 0.62 indicates colleges & universities were not viewed as meeting needs as effectively as the firms would like (the higher the value, the less needs were met by the colleges).

Average Rank of All Applied Areas (48)			
	Importance to* <u>Your Firm</u>	Needs Met by Area ** <u>Colleges &amp; Univ's</u>	<u>Average Difference</u>
<b>Small Firms</b>	2.56	2.41	-0.15
<b>Large Firms</b>	2.03	2.80	0.77
<b>All Firms Average</b>	2.09	2.71	0.62
*Rank 1 = Most Important 4 = Least Important			
** Rank 1 = Meets Needs 4 = Does Not meet Needs			

There were only nine *Applied Areas* in which all firms considered their needs were being met by area colleges and universities:

1. Computer Systems/Architecture
2. Directors, Circuits & Systems.
3. Communications – Control and Signal Processing
4. Applied Manufacturing, Production, Operations
5. Languages/CASE
6. AI/ES/Inference Engines
7. Numerical Computing/Algorithms
8. Technical Competencies
9. Marketing Concepts

None of these *Applied Areas* were included in the 22 *Applied Areas* ranked most important by all firms.

Conversely, the greatest gap between firms' needs and college and university performance occurred in *Applied Areas* ranked most important by the firms. For example, TABLE I shows that 15 of the 22 *Applied Areas* had an average difference between firm rank and needs met by area colleges & universities exceeding 1.00. Those important *Applied Areas* are:

- Protocols, ATM, TCP/IP, Frame Relay, ADSL
- Telephony
- Software/Hardware Configuration
- LAN/WAN
- Quality Assurance
- Architectures/Platforms
- Methodology

## Findings

- Project Management
- Security
- Protocols
- Integration
- Convergence
- Servers, Bridges, Routers and Hubs
- Security Encryption, Firewalls
- Continuity, Interruption & Recovery

Of the seven remaining high ranked *Applied Areas*, five were above the average gap of 0.62. These results suggest the *Academic Areas* most important to firms are the *Academic Areas* where local colleges and universities are less successful in meeting these firms' needs.

# Findings

**TABLE I**  
**APPLIED AREAS RANKED BETWEEN 1.0 AND 2.0**  
**Compared to Needs Met by Colleges & Universities**  
**All Firms**

Academic Discipline - Applied Area	Rank of * Discipline	Rank of Appl * Area	Needs Met** by Coll & Univ	Average Difference All Firms
<b>Electronic Engineering</b>	2.59			
<b>Telecommunications</b>	1.72			
- Protocols, ATM, TCP/IP, Frame Relay, ADSL		1.44	2.98	1.54
- Telephony		1.87	2.92	1.05
- Fiber Optics		1.92	2.86	0.94
<b>Systems Integration</b>	1.39			
- Software/Hardware Configuration		1.68	2.75	1.07
- LAN/WAN		1.39	2.83	1.44
- Quality Assurance		1.61	3.05	1.44
<b>Computer Engineering &amp; Systems</b>	1.93			
- Architectures/Platforms		1.76	2.80	1.04
- Standards and Documentation		1.75	2.70	0.95
<b>Systems Development &amp; Business Integration</b>	1.74			
- Methodology		1.97	3.03	1.06
- Data Warehousing		1.76	2.75	0.99
- Client/Server		1.77	2.19	0.42
- Design/Programming		1.49	2.24	0.75
- Decision Support		1.83	2.72	0.89
<b>Technology Management</b>	1.83			
- Project Management		1.79	2.82	1.03
<b>Technical Marketing</b>	2.98			
<b>E-commerce</b>	1.95			
- Development Technologies		1.75	2.24	0.49
- Security		1.36	3.09	1.73
<b>Networking (LAN/WAN/IP)</b>	1.24			
- Protocols - Open & Proprietary		1.92	3.01	1.09
- Integration		1.60	3.05	1.45
- Convergence		1.62	3.12	1.50
- Servers, Bridges, Routers and Hubs		1.38	3.02	1.64
- Security Encryption		1.31	3.23	1.92
- Continuity, Interruption & Recovery		1.31	3.31	2.00

\*Rank 1 = Most Important 4 = Least Important

\*\* Rank 1 = Meets Needs 4 = Does Not Meet Needs

# Findings

## 2. Highest Ranked Applied Areas

The two highest ranked Applied Areas were *Security, Encryption, Firewalls* and *Continuity, Interruption & Recovery*, each with composite scores from all firms of 1.31. This suggests a very large number of number 1 rankings.

There were 11 of the 22 top scoring Applied Areas in the Networking/E-commerce/Telecommunications areas documenting further the relevance of the “wired world” Midwest firms are entering.

Table 1 documents 22 Applied Areas that were scored between 1.00 and 2.00 by all firms. A review of these Applied Areas suggest four major groupings that are important to business:

- *Client/Server*, Networked Platform and related technology, Communication *Protocols*, and the applications that will run on that platform;
- *Business Planning/Re-engineering, Project Management, Technical Management and Quality Assurance* associated with Security; plus the *Continuity, Interruption and Recovery* required for the designated maintenance of these hardware and application environments.
- *Data Warehousing, Methodologies, Design/Programming*, associated with expanded strategic expectations from data and systems on emerging platforms.
- E-commerce *Development Technologies and Security* and increased relevance of networking, documents a clear migration in corporate employment and focus.

The strength of the scoring in these Applied Areas will continue to be of great interest to area academic institutions.

While major new programs and courses are being developed or are now available – particularly client server, communications, networking and E-commerce – the business need caused by rapid industry changes are outstripping the availability of desired educational services.

# Findings

## D. INSTITUTIONAL RESPONSIVENESS

### a.) Responsiveness by Type of Institution

Employers were asked to report how responsive different types of educational institutions were in meeting their needs. The following data suggest that the community colleges/technical institutions are viewed as slightly more responsive than four-year colleges and universities. They were much more responsive than private trade schools.

#### Responsiveness by Type of Institution

	Small	Large	Total
Private Trade Schools	2.29	1.53	2.06
Community Colleges/Technical Institutions	1.51	1.81	1.61
Four-Year Colleges and Universities	1.56	1.80	1.64

*Rank 1 = Very Responsive*

*3 = Seldom Responsive*

### b.) Preparedness of Graduates

Employers were also asked to report how prepared graduates from different types of educational institutions were when employed. The data also shows a slightly higher rank for community colleges/technical institutions.

#### Preparedness of Graduates

	Small	Large	Total
Private Trade Schools	1.80	1.49	1.70
Community Colleges/Technical Institutions	1.51	1.87	1.62
Four-Year Colleges and Universities	1.54	1.88	1.65

*Rank 1 = Very Responsive*

*3 = Seldom Responsive*

# Findings

## E. TECHNOLOGY AREAS

### 1. General Comments

There is an array of information topics that transcend the various *Academic Disciplines* and *Applied Areas*. In some cases they are functional issues like data and languages while in other cases they are the emerging issues within information processing. These *Technology Areas* will provide focus to any of the *Academic Disciplines* and *Applied Areas*. To illustrate, E-commerce has an engineering dimension to it. It also has issues of web design, security, legal, graphics, audio, data management, systems integration, etc. It also includes technology management and technology marketing issues. It will impact future systems development and will probably become a very important part of the operating structure of a business enterprise.

Table II shows Technology Areas that were ranked by small and large firms today and in five years.

Some of the *Technology Areas* like Data have been around for a long time. With the emerging technological platforms and the new forms of digitized content, the issues surrounding data are substantially broader than historically covered by traditional courses.

The survey results also show that virtually all of the *Technology Areas* will become even more important in five years. These data suggest that if colleges and universities limit curriculum and academic programs, they may miss future markets.

**TABLE II**  
**RANKING OF TECHNOLOGY AREAS**  
**BY SMALL & LARGE FIRMS**

Technology Areas	1999		In Five Years	
	Small Firms	Large Firms	Small Firms	Large Firms
Languages	2.59	2.15	2.34	2.11
Data	2.06	1.61	1.69	1.22
Telecommunications	2.96	1.32	1.84	1.29
Client/Server	2.18	1.96	1.64	1.34
Human Factors Engineering	3.07	2.31	2.70	1.89
Education Technologies/ Learning Services	2.84	2.39	2.34	2.53
E-commerce	2.21	1.75	1.95	1.98
CAD/CAM/CAE	3.18	2.92	2.67	2.64
Object-Oriented Design	3.12	2.06	2.65	2.34
Artificial Intelligence	3.26	3.16	2.57	2.50
Multimedia-Technology	2.50	2.53	2.24	2.14
Multimedia-Presentation	2.47	2.32	2.21	2.41
Virtual Reality	3.04	3.21	2.72	3.11

Rank 1 = Most Important 4 = Least Important

# Findings

## 2. Data, Telecommunications, Client/Server, Languages

TABLE III shows composite rankings for all firms and brings these *Technology Areas* into sharper focus. The highest-ranked cluster of *Technology Areas* was Telecommunications, Data, E-commerce and Client/Server. This cluster characterizes the rapidly emerging electronic information processing platform for corporate America. In five years, each of these areas is considered to be more important. The largest firms ranked Human Factors Engineering fifth most important in five years. These results suggest all future systems and services must be “user friendly” for employees and customers alike.

**TABLE III  
HIGHEST RANKING TECHNOLOGY AREAS  
ALL FIRMS**

<b>Technology Area</b>	<b>2002 All Firms</b>	<b>In 5 Years - All Firms</b>
Telecommunications	1.46	1.36
Data	1.67	1.28
E-commerce	1.82	1.96
Client/Server	1.99	1.37
Human Factor Engineering	2.42	1.99

*Rank 1 = Most Important 4 = Least Important*

# Findings

## F. VENDOR CERTIFICATIONS

In recent years, *Vendor Certifications* have become an increasingly important part of the IT training plans for many corporations. As noted earlier, the 73 firms in the study that provided detail training data report they are now spending nearly \$825,000 on *Vendor Certifications*. That number is expected to be over \$1.2 million in five years or a 46.6% growth.

Firms were asked to rank seven different *Vendor Certifications*. TABLE IV shows ranking for all 124 firms in the study. These data show:

- Microsoft and Cisco were ranked highest by all 124 firms. Microsoft was the clear "winner" for small firms with a score of 1.64, going to 1.43 in five years (Appendix C).
- Cisco was the second highest ranked certification – showing a very similar pattern to Microsoft.
- Small firms, as a group, ranked certifications as more important to their technology strategies than did larger firms (Appendix C).

**TABLE IV**  
**RANKING OF VENDOR CERTIFICATIONS**  
**ALL FIRMS**

<b>Vendor Certifications</b>	<b>2002 All Firms</b>	<b>In 5 Years All Firms</b>
Microsoft	2.81	2.34
Novel	3.45	3.38
Lotus Notes	3.64	3.58
Cisco	2.84	2.42
Oracle	3.17	2.80
People Soft	3.82	3.67
Linux	3.88	3.24

*Rank 1 = Most Important 4 = Least Important*

## Findings

Appendix C shows other special topics such as Technologies, Professional Development, Programming and Development, and Database. Table V below shows the top ranked disciplines in these various special topics. Note that several management issues associated with the requirements of the emerging E-world are ranked high by firms. Project Management – with a score of 1.27 – stands out as a critical management issue in five years, ranking first in importance for large firms and second for small firms.

**TABLE V**  
**RANKING OF PROFESSIONAL DEVELOPMENT TOPICS**  
**ALL FIRMS**

<b>Professional Development Topics</b>	<b>2002 All Firms</b>	<b>In 5 Years All Firms</b>
WAN/LAN	2.08	1.88
TCP/IP	2.07	1.97
VPN	2.88	2.01
Wireless	2.67	1.85
Project Management (PPM)	2.56	1.27
Security (SANS/CISSP)	2.19	2.09
Disaster Planning & Recovery	2.55	2.11
SQL	2.21	2.09

*Rank 1 = Most Important 4 = Least Important*

## Conclusions

The Midwest Regional Information Technology Survey included 124 Midwest firms with total employment of over 32,200 employees.

IT employees totaled 1,873 or 5.8% of all employees in responding firms.

Other significant survey numbers include:

- 11.2% or 3,618 of all employees from responding firms are currently taking academic courses.
- 18.9% of employees taking academic courses are in tuition reimbursement programs.
- Total training budgets for the 73 firms reporting these data were over \$4.5 million now and projected to exceed \$6.1 million in five years.
- For firms reporting these data, the per employee training budget is:

	<b>Training Budget Per Employee</b>	
	<b><u>2002</u></b>	<b><u>Five Years</u></b>
<b>All Employees</b>	\$ 256	\$ 312
<b>I.T. Employees</b>	\$1,345	\$1,367

Unfortunately, the study methodology will not allow use of above values to develop estimates for total community training budgets and total IT employment. In addition, with only 73 of the 124 respondents providing training budget information, the values reported will substantially understate the total training budget of the 124 survey firms.

Numerous additional conclusions are appropriate:

1. Expenditures for training and education will increase faster than employment. (Employment up 9.2% in five years with training up nearly 35.1%.)
2. Tuition budgets will grow (116.0%) much faster than as internally provided programs (75.3%), creating growing market opportunities for providers. However, tuition budgets were only \$209,000 – 6.9% current training budgets. External seminars and workshops total \$1.1 million or 36% of the total training budget. Firms will increase spending for external training (33.2%) and vendor certificates (46.6%).
3. Training budgets for IT professional positions will grow 12.7% over the next five years, about equal to the projected 11.5% growth in the IT employment.
4. IT training budgets per employee are over four times the amount for non-IT employees now and in five years. This creates a very fast growth industry for IT professional training at all levels.

## Conclusions

5. Most firms reported only employees in the Computer department as IT employees. This probably understates the number of IT professionals - - missing professional technology sales personnel, operations and production floor specialists, training and education professionals and other departmental IT professionals.
6. The strongest demand for curriculum and programs included:
  - Security
  - Continuity, Interruption & Recovery
  - Networking (LAN/WAN/IP)
  - Telecommunications
  - Client/Server
  - E-commerce
  - Systems Integration
  - Project Management
  - Quality Assurance
  - Design/Programming
  - Development Technologies
  - Architectures/Platforms
7. A large potential market continues for non-traditional students at postsecondary institutions. This study shows that over 40% of all current IT professional employees have sub-baccalaureate degrees but firms plan for more employees with baccalaureate or graduate degrees.
8. These data also argue strongly for the need to remove barriers to continued educational growth and academic achievement for employees. Good articulation agreements are essential to assure community/technical college graduates have good opportunities to gain baccalaureate and graduate degrees in the future. Other barriers to secure additional education include issues associated with distance, incomplete curriculum/program offerings and obsolete offerings.
9. Market development by academic institutions would be well served if unique groups of non-traditional students could be identified and then programs developed to target their unique needs.
10. The demand for new IT graduates from all area colleges and universities will continue to grow in the foreseeable future.

## Appendix A

### MIDWEST CENTER FOR INFORMATION TECHNOLOGY PARTNERS

Central Community College - Nebraska  
Iowa Western Community College - Iowa  
Metropolitan Community College - Nebraska  
Mid-Plains Community College Area - Nebraska  
North Dakota State College of Science - North Dakota  
Northeast Community College - Nebraska  
Southeast Community College - Nebraska  
Southeast Technical Institute - South Dakota  
Western Iowa Tech Community College - Iowa  
Western Nebraska Community College - Nebraska

Applied Information Management Institute - Nebraska

## Appendix B

### SURVEY PARTICIPANTS

Advanced Computer Services  
Affiliated Foods  
All Power, Inc.  
ALLTEL  
AmFirst Bank, N.A.  
Applied Engineering, Inc.  
Arwave Wireless Communications  
Avera St. Anthony's Hospital  
Becton Dickinson  
Besser Sioux City  
Blue Cross Blue Shield of North Dakota  
Brooks Law Offices, P.C.  
Brown & Saenger  
Bureau of Reclamation  
Central Nebraska Medical Clinic, P.C.  
Chase County Community Hospital  
Citibank  
City of Fergus Falls  
City of McCook  
City of Ogallala  
City of Scottsbluff  
CNH  
Community Hospital – McCook  
Connecting Point  
Connecting Point Technology Center  
Copycat Printing  
Corporate Technologies  
D.T.S., Inc.  
Dacotah Paper Co.  
Database By Design  
DeLong Sportswear  
Duncan Aviation  
Education Service Unit #13  
Education Service Unit #15  
Enterprise Solutions, Inc.  
Farm Credit Services of America  
Farmers Cooperative Association  
Farmers State Bank  
First National Bank  
First National Bank of Omaha  
FM Acoustical Tile, Inc.  
Freeman  
Frenchman Valley Farmers Cooperative, Inc.  
Frontier  
Gering Public Schools  
GSG Foodservice  
Great Plains Capital  
Greater Omaha Chamber of Commerce  
Hansen Manufacturing Corp.  
Hemingford Cooperative Telephone Co.  
Heritage Group  
Hiland-Roberts, Inc.  
Hi-Line Cooperative, Inc.  
Holiday Inn Express  
Hornady Manufacturing Company  
Information Analytics  
KDUH Television  
Keith County  
KELN-FM/KOOQ-AM  
Kildore Lumber Co.  
Kircher & Associates Reality, Inc.  
Kolberg Pioneer, Inc.  
Lisle Corporation  
McCook Area Chamber of Commerce  
McCook Clinic, P.C.  
McCook Daily Gazette  
McCook Eye Clinic, P.C.  
McCook National Bank  
McCook Public Schools  
McPherron Skiles Joel & Loop  
Memorial Health Center  
Mid-Plains Community Area  
Miller, Neidhardt & Associates, P.C.  
Minnesota WebWorks  
NDSCS  
Nebraska Air National Guard  
Nebraska Public Power District  
Nebraska State Patrol  
NISC  
Nishna Productions, Inc.  
Norfolk Iron and Metal, Inc.  
Nucor Steel  
Omaha Public Power District  
Owen Industries  
Panhandle Community Services  
Parker Hannifin Corporation  
Pathology Services, P.C.  
Perfection Learning Corporation  
Phyto-Technologies, Inc.  
Pinpoint  
Principal Financial Group  
Pro Printing

## Appendix B

### SURVEY PARTICIPANTS (continued)

Raytheon  
Red Willow County FSA  
Republican Valley Motor Co.  
Runge Enterprises, Inc.  
Saint Francis Medical Center  
Sargent Pipe Company, Inc.  
Security Equipment, Inc.  
Sidney Medical Associates  
Southwest PPD  
SRCC  
State of NE, Dept. of Correctional Services  
TechLink

Telco Triad Community Credit Union  
The Goodyear Tire & Rubber Co.  
Titan Industries  
Transcrypt  
Union Bank & Trust  
Valley Bank  
Vishay Dale Electronics  
Western Sugar Company  
Wiedeman Financial Services, Ltd.  
Workplace Technology Center  
XS Consulting Group  
Yellow Jacket Manufacturing, Inc.

## Appendix C

### 124 TOTAL FIRMS REPORTING LARGE AND SMALL FIRMS

All Employees – 124 Regional Firms		2002	Forecast In 5 Years	Percent Change
1.	Number of All Employees	32,206	35,157	9.16%
2.	Number of ALL Employees Now Taking Academic Credit Courses	3,618		
3.	Number of All Employees You Feel Should Be Taking Academic Courses	6,826		
4.	Number of Those Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program:	684		
5.	Education/Training Budget*	\$4,522,371	\$6,110,084	35.11%
	Amount of Training Budget for:**			
a.	Internally Provided Training Programs	\$ 779,384	\$1,365,978	75.26%
b.	External Seminars & Workshops	\$1,098,268	\$1,462,899	33.20%
c.	Industry Certificates	\$ 825,010	\$1,209,012	46.55%
d.	Tuition & Cost for College Courses	\$ 208,775	\$ 450,866	115.96%
e.	Other	\$ 132,950	\$ 111,465	-16.16%
<b>Information Technology Employees</b>				
6.	Number of Information Technology Employees	1,873	2,089	11.54%
7.	Number of Information Technology Employees Now Taking Academic Credit Courses	187		
8.	Number of Information Technology Employees You Feel Should be Taking Academic Courses	747		
9.	Number of Those IT Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	59		
10.	Number of Information Technology Employees Now Taking Industrial Certification Courses	163		
11.	Education/Training Budget - IT Employees Only	\$1,788,063	\$2,015,700	12.73%

\* 73 of the 124 firms provided education/training budget information.

\*\* 57 of the 124 firms provided information on the amounts of their training budget for items 5a-5e. Therefore, training budget items 5a-5e do not equal the total training budget.

## Appendix C

### PROFILE OF ACADEMIC DISCIPLINES FOR INFORMATION TECHNOLOGY EMPLOYEES 124 Regional Firms

#### Estimated Percent of Employees by Academic Disciplines

ACADEMIC DISCIPLINES	Rank Importance of Discipline to Your Firm*	% IT Employees with these Disciplines 2002	%Employees with these Disciplines in 5 yrs
Electronic Engineering	2.59	7.12	7.15
Telecommunications	1.72	9.37	9.68
Systems Integration	1.39	11.90	12.37
Computer Engineering & Systems	1.93	9.46	10.29
Systems Development & Business Integration	1.74	20.30	17.44
Technology Management	1.83	10.29	9.65
Technical Marketing	2.98	4.59	5.30
E-commerce	1.95	7.95	9.06
Networking (LAN/WAN/IP)	1.24	11.71	12.43
	% Sub - Baccalaureate	40.13	30.37
	% Baccalaureate	50.16	53.28
	% Graduate	9.70	16.34

#### Estimated Number of Employees by Academic Disciplines

ACADEMIC DISCIPLINES	Rank Importance of Discipline to Your Firm*	# IT Employees with these Disciplines 2002	# Employees with these Disciplines in 5 yrs	Percent Change
Electronic Engineering	2.59	138	153	10.97
Telecommunications	1.72	182	207	14.21
Systems Integration	1.39	231	265	14.91
Computer Engineering & Systems	1.93	183	220	20.17
Systems Development & Business Integration	1.74	393	373	-5.08
Technology Management	1.83	199	207	3.61
Technical Marketing	2.98	89	113	27.42
E-commerce	1.95	154	194	26.00
Networking (LAN/WAN/IP)	1.24	227	266	17.24
	# Sub - Baccalaureate	752	635	-15.55
	# Baccalaureate	939	1113	18.53
	# Graduate	182	341	87.36

\* 1 = Most Important 4 = Least Important

## Appendix C

### IMPORTANCE OF APPLIED AREAS

124 Regional Firms

Rank Each Applied Area	*Rank of Area	**Need Met by Colleges & Univs	*** Differences
<b>Electronic Engineering</b>			
- Computer Systems/Architecture	2.45	2.31	-0.14
- Directories, Circuits & Systems	3.09	2.70	-0.39
- Comm's, Control & Signal Processing	2.97	1.96	-1.01
- Other			
<b>Telecommunications</b>			
- Protocols, ATM, TCP/IP, Frame Relay, ADSL	1.44	2.98	1.54
- Wireless	2.27	3.30	1.03
- Telephony	1.87	2.92	1.05
- Fiber Optics	1.92	2.86	0.94
- Other			
<b>Systems Integration</b>			
- Software/Hardware Configuration	1.68	2.75	1.07
- LAN/WAN	1.39	2.83	1.44
- Technical Purchasing (RFI, RFP, ROI)	2.71	2.88	0.17
- Applied Mfg, Production, Operations	3.38	1.67	-1.71
- Installation/Implementation	2.41	2.61	0.20
- Quality Assurance	1.61	3.05	1.44
- Other			
<b>Computer Engineering &amp; Systems</b>			
- Operating Systems/Compilers/Tools	2.17	2.53	0.36
- Language/CASE	2.18	1.63	-0.55
- AI/ES/Inference Engines	3.16	2.65	-0.51
- Architectures/Platforms	1.76	2.80	1.04
- Capacity and Performance Planning	2.01	3.01	1.00
- Numerical Computing, Algorithms	1.97	2.08	-0.89
- Operations Research	2.84	2.90	0.06
- Standards/Documentation	1.75	2.70	0.95
- Other			
<b>Systems Development &amp; Business Integration</b>			
- Methodology	1.97	3.03	1.06
- Data Warehousing	1.76	2.75	0.99
- Client/Server	1.77	2.19	0.42
- Business Planning/Re-Engineering	2.16	3.05	0.89
- Human Factors Engineering	2.28	3.12	0.84
- Design/Programming	1.49	2.24	0.75
- Decision Support Systems	1.83	2.72	0.89
- Other			
<b>Technology Management</b>			
- Project Management	1.79	2.82	1.03
- Business Planning Strategies/Tactics	2.13	3.12	0.99
- Specific Technical Competencies	2.17	3.08	0.91
- Communications Law, Regulation	2.20	2.89	0.69
- Legal/Ethical/Human Resource Mgmt.	2.06	2.44	0.38
- Technology & Social/Economic Change	2.10	2.42	0.32
- Other			

\*1 = Most Important    4 = Least Important

\*\*1 = Meets Needs    4 = Does Not Meet Needs

\*\*\* A positive value suggests needs are not being met. A negative value suggests needs are being met.

## Appendix C

### IMPORTANCE OF APPLIED AREAS 124 Regional Firms (Continued)

Rank Each Applied Area	*Rank of Area	**Need Met by Colleges & Univs	*** Differences
<b>Technical Marketing</b>			
- Business Planning, Strategies, Tools	2.61	2.65	0.04
- Technical Competencies	2.49	2.21	-0.28
- Marketing Concepts	2.68	2.24	-0.44
- Other			
<b>E-commerce</b>			
- Development Technologies	1.75	2.24	0.49
- Legal/Public Policy Issues	2.26	2.72	0.46
- Business Opportunity/Risk	2.26	2.76	0.50
- Management & Control	2.08	2.66	0.58
- Security	1.36	3.09	1.73
- Other			
<b>Networking (LAN/WAN/IP)</b>			
- Protocols - Open and Proprietary	1.92	3.01	1.09
- Integration	1.60	3.05	1.45
- Convergence	1.62	3.12	1.50
- Servers, Bridges, Routers and Hubs	1.38	3.02	1.64
- Security, Encryption, Firewalls	1.31	3.23	1.92
- Continuity, Interruption & Recovery	1.31	3.31	2.00
- Other			
<b>Overall Average</b>	<b>2.09</b>	<b>2.71</b>	<b>0.62</b>

\*1 = Most Important    4 = Least Important  
 \*\*1 = Meets Needs    4 = Does Not Meet Needs  
 \*\*\* A positive value suggests needs are not being met. A negative value suggests needs are being met.

## Appendix C

### RANKING\* OF TECHNOLOGY AREAS 124 REGIONAL FIRMS

Technology Areas	Rank* 2002	In 5 Years
- Languages	2.22	2.14
- Data	1.67	1.28
- Telecommunications	1.46	1.36
- Client/Server	1.99	1.37
- Human Factors Engineering	2.42	1.99
- Educational Technologies/Learning Services	2.45	2.51
- E-commerce	1.82	1.96
- CAD/CAM/CAE	2.96	2.65
- Object-Oriented Design	2.21	2.39
- Artificial Intelligence	3.18	2.51
- Multimedia - The Technologies	2.53	2.14
- Multimedia – The Presentation	2.35	2.37
- Virtual Reality	3.16	3.06

\* 1 = Most Important 4 = Least Important

# Appendix C

## IT CERTIFICATIONS 124 REGIONAL FIRMS

Rank Each Certification	*Rank	
	2002	5 Years
<b>Vendor Certifications</b>		
- Microsoft	2.81	2.34
- Novell	3.45	3.38
- Lotus Notes	3.64	3.58
- Cisco	2.84	2.42
- Oracle	3.17	2.80
- PeopleSoft	3.82	3.67
- Linux	3.88	3.24
- Other		
<b>Technologies</b>		
- WAN/LAN	2.08	1.88
- TCP/IP	2.07	1.97
- VPN	2.88	2.01
- Wireless	2.67	1.85
- Other		
<b>Professional/Other</b>		
- Project Management (PPM)	2.56	1.27
- Security (SANS/ CISSP)	2.19	2.09
- Disaster Planning & Recovery	2.55	2.11
- A+	2.75	2.75
- Net+	3.13	3.21
- Other		
<b>Programming &amp; Development</b>		
- XML	3.48	2.96
- Java/ JavaScript	3.38	2.83
- HTML	3.22	2.65
- C++	3.28	3.00
- Visual Basic	3.37	2.96
- Other		
<b>Database</b>		
- Oracle	2.51	2.22
- SQL	2.21	2.09
- MS-SQL	2.75	2.54
- SQL Server	2.58	2.56
- DB2	2.84	2.52
- Crystal Reports	3.39	3.20
- Other		

\*1 = Most Important    4 = Least Important

# Appendix C

## COLLEGE RESPONSIVENESS TO FIRMS' NEEDS 124 REGIONAL FIRMS

	*Rank of Area
<hr/> Rank Responsiveness of Area Initiatives in Meeting Your Firm's Educational Needs in IT <hr/>	
- Private Trade Schools	2.27
- Community College/Technical Institute	1.76
- 4-Year Colleges & Universities	1.81
<hr/> How Prepared Are Graduates to Meet Your Firm's Job Requirements <hr/>	
- Private Trade Schools	1.88
- Community College/Technical Institute	1.79
- 4-Year Colleges & Universities	1.82

\* 1 = Very Responsive      3 = Seldom Responsive

# Appendix C

## 78 FIRMS WITH LESS THAN 100 EMPLOYEES

All Employees	2002	Forecast In 5 Years	Percent Change
1. Number of All Employees	2,506	3,069	22.47%
2. Number of ALL Employees Now Taking Academic Credit Courses	131		
3. Number of All Employees You Feel Should Be Taking Academic Courses	458		
4. Number of Those Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program:	16		
5. Education/Training Budget *	\$ 504,070	\$ 662,200	31.37%
Amount of Training Budget for:**			
a. Internally Provided Training Programs	\$ 100,543	\$ 147,740	46.94%
b. External Seminars & Workshops	\$ 229,027	\$ 235,960	3.03%
c. Industry Certificates	\$ 136,920	\$ 181,495	32.56%
d. Tuition & Cost for College Courses	\$ 40,100	\$ 70,130	74.89%
e. Other	\$ 7,950	\$ 5,465	-31.26%
<b>Information Technology Employees</b>			
6. Number of Information Technology Employees	266	408	53.48%
7. Number of Information Technology Employees Now Taking Academic Credit Courses	26		
8. Number of Information Technology Employees You Feel Should be Taking Academic Courses	80		
9. Number of Those IT Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	5		
10. Number of Information Technology Employees Now Taking Industrial Certification Courses	58		
11. Education/Training Budget - IT Employees Only	\$ 94,400	\$ 152,600	61.65%

\* 48 of the 78 firms provided education/training budget information.

\*\* 27 of the 78 firms provided information on the amounts of their training budget for items 5a-5e. Therefore, training budget items 5a-5e do not equal the total training budget.

## Appendix C

### PROFILE OF ACADEMIC DISCIPLINES FOR INFORMATION TECHNOLOGY EMPLOYEES 78 FIRMS WITH LESS THAN 100 EMPLOYEES

#### Estimated Percent of Employees by Academic Disciplines

ACADEMIC DISCIPLINES	Rank Importance of Discipline to Your Firm*	% IT Employees with these Disciplines 2002	%Employees with these Disciplines in 5 yrs
Electronic Engineering	2.84	10.85	10.10
Telecommunications	2.29	13.67	12.77
Systems Integration	2.00	12.54	12.01
Computer Engineering & Systems	2.16	12.88	13.52
Systems Development & Business Integration	2.28	10.51	10.26
Technology Management	1.97	10.85	10.18
Technical Marketing	2.13	6.55	7.09
E-commerce	2.17	6.44	7.72
Networking (LAN/WAN/IP)	1.71	12.54	13.06
	% Sub - Baccalaureate	54.35	34.64
	% Baccalaureate	29.89	38.24
	% Graduate	15.76	27.12

#### Estimated Number of Employees by Academic Disciplines

ACADEMIC DISCIPLINES	Rank Importance of Discipline to Your Firm*	# IT Employees with these Disciplines 2002	# Employees with these Disciplines in 5 yrs	Percent Change
Electronic Engineering	2.84	29	41	42.85
Telecommunications	2.29	36	52	43.31
Systems Integration	2.00	33	49	47.03
Computer Engineering & Systems	2.16	34	55	61.05
Systems Development & Business Integration	2.28	28	42	49.89
Technology Management	1.97	29	41	44.03
Technical Marketing	2.13	17	29	66.09
E-commerce	2.17	17	31	83.92
Networking (LAN/WAN/IP)	1.71	33	53	59.79
	# Sub - Baccalaureate	144	141	-2.08
	# Baccalaureate	80	156	95.00
	# Graduate	42	111	164.29

\* 1 = Most Important 4 = Least Important

## Appendix C

### IMPORTANCE OF APPLIED AREAS 78 FIRMS WITH LESS THAN 100 EMPLOYEES

Rank Each Applied Area	*Rank of Area	**Need Met by Colleges & Univs	*** Differences
<b>Electronic Engineering</b>			
- Computer Systems/Architecture	2.33	2.06	-0.27
- Directories, Circuits & Systems	3.50	1.82	-1.68
- Comm's, Control & Signal Processing	3.34	1.96	-1.38
- Other			
<b>Telecommunications</b>			
- Protocols, ATM, TCP/IP, FrameRelay, ADSL	2.86	2.15	-0.71
- Wireless	2.68	2.17	-0.51
- Telephony	2.95	2.15	-0.80
- Fiber Optics	3.10	2.36	-0.74
- Other			
<b>Systems Integration</b>			
- Software/Hardware Configuration	1.94	2.23	0.29
- LAN/WAN	2.14	2.23	0.09
- Technical Purchasing (RFI, RFP, ROI)	2.90	2.18	-0.72
- Applied Mfg, Production, Operations	3.23	2.26	-0.97
- Installation/Implementation	2.54	2.11	-0.43
- Quality Assurance	2.48	2.07	-0.41
- Other			
<b>Computer Engineering &amp; Systems</b>			
- Operating Systems/Compilers/Tools	2.57	2.16	-0.41
- Language/CASE	2.94	2.18	-0.76
- AI/ES/Inference Engines	3.34	2.45	-0.89
- Architectures/Platforms	2.78	2.49	-0.29
- Capacity and Performance Planning	2.89	2.35	-0.54
- Numerical Computing, Algorithms	3.26	2.04	-1.22
- Operations Research	3.29	2.18	-1.11
- Standards/Documentation	2.87	2.77	-0.10
- Other			
<b>Systems Development &amp; Business Integration</b>			
- Methodology	2.47	2.72	0.25
- Data Warehousing	2.46	2.62	0.16
- Client/Server	2.08	2.55	0.47
- Business Planning/Re-Engineering	2.54	2.64	0.10
- Human Factors Engineering	2.78	2.55	-0.23
- Design/Programming	2.42	2.49	0.07
- Decision Support Systems	2.69	2.71	0.02
- Other			
<b>Technology Management</b>			
- Project Management	1.91	2.53	0.62
- Business Planning Strategies/Tactics	2.07	2.59	0.52
- Specific Technical Competencies	2.42	2.58	0.16
- Communications Law, Regulation	2.56	2.76	0.20
- Legal/Ethical/Human Resource Mgmt.	2.46	2.71	0.25
- Technology & Social/Economic Change	2.51	2.72	0.21
- Other			

\*1 = Most Important    4 = Least Important

\*\*1 = Meets Needs    4 = Does Not Meet Needs

\*\*\* A positive value suggests needs are not being met. A negative value suggests needs are being met.

## Appendix C

### IMPORTANCE OF APPLIED AREAS 78 FIRMS WITH LESS THAN 100 EMPLOYEES (Continued)

Rank Each Applied Area	*Rank of Area	**Need Met by Colleges & Univs	*** Differences
<b>Technical Marketing</b>			
- Business Planning, Strategies, Tools	2.71	2.58	-0.13
- Technical Competencies	2.30	2.76	0.46
- Marketing Concepts	2.33	2.81	0.48
- Other			
<b>E-commerce</b>			
- Development Technologies	2.35	2.60	0.25
- Legal/Public Policy Issues	2.50	2.53	0.03
- Business Opportunity/Risk	2.35	2.53	0.18
- Management & Control	2.33	2.43	0.10
- Security	1.96	2.43	0.47
- Other			
<b>Networking (LAN/WAN/IP)</b>			
- Protocols - Open and Proprietary	2.28	2.34	0.06
- Integration	1.98	2.54	0.56
- Convergence	2.26	2.57	0.31
- Servers, Bridges, Routers and Hubs	2.06	2.03	-0.03
- Security, Encryption, Firewalls	1.93	2.52	0.59
- Continuity, Interruption & Recovery	2.07	2.61	0.54
- Other			
<b>Overall Average</b>	<b>2.56</b>	<b>2.41</b>	<b>-0.15</b>

\*1 = Most Important    4 = Least Important

\*\*1 = Meets Needs    4 = Does Not Meet Needs

\*\*\* A positive value suggests needs are not being met. A negative value suggests needs are being met.

## Appendix C

### RANKING\* OF TECHNOLOGY AREAS 78 FIRMS WITH LESS THAN 100 EMPLOYEES

Technology Areas	2002	Rank*	In 5 Years
- Languages	2.59		2.34
- Data	2.06		1.69
- Telecommunications	2.29		1.84
- Client/Server	2.18		1.64
- Human Factors Engineering	3.07		2.70
- Educational Technologies/Learning Services	2.84		2.34
- E-commerce	2.21		1.95
- CAD/CAM/CAE	3.18		2.67
- Object-Oriented Design	3.12		2.65
- Artificial Intelligence	3.26		2.57
- Multimedia - The Technologies	2.50		2.24
- Multimedia – The Presentation	2.47		2.21
- Virtual Reality	3.04		2.72

\* 1 = Most Important 4 = Least Important

# Appendix C

## IT CERTIFICATIONS 78 FIRMS WITH LESS THAN 100 EMPLOYEES

Rank Each Certification	2002	*Rank 5 Years
<b>Vendor Certifications</b>		
- Microsoft	1.64	1.43
- Novell	2.52	2.69
- Lotus Notes	2.74	2.85
- Cisco	2.19	2.05
- Oracle	2.81	2.68
- PeopleSoft	3.18	3.10
- Linux	2.67	2.71
- Other		
<b>Technologies</b>		
- WAN/LAN	2.27	1.97
- TCP/IP	2.27	1.97
- VPN	2.31	2.19
- Wireless	2.26	1.65
- Other		
<b>Professional/Other</b>		
- Project Management (PPM)	2.08	1.73
- Security (SANS/ CISSP)	2.18	1.79
- Disaster Planning & Recovery	2.18	1.93
- A+	2.90	2.44
- Net+	3.02	2.57
- Other		
<b>Programming &amp; Development</b>		
- XML	3.12	2.30
- Java/ JavaScript	2.75	2.29
- HTML	2.47	2.30
- C++	3.12	2.60
- Visual Basic	2.95	2.35
- Other		
<b>Database</b>		
- Oracle	3.02	2.34
- SQL	2.20	1.87
- MS-SQL	2.54	2.11
- SQL Server	2.23	2.10
- DB2	3.05	2.31
- Crystal Reports	2.82	2.36
- Other		

\*1 = Most Important    4 = Least Important

## Appendix C

### COLLEGE RESPONSIVENESS TO FIRMS' NEEDS 78 FIRMS WITH LESS THAN 100 EMPLOYEES

	*Rank of Area
<hr/> Rank Responsiveness of Area Initiatives in Meeting Your Firm's Educational Needs in IT <hr/>	
- Private Trade Schools	2.00
- Community College/Technical Institute	1.77
- 4-Year Colleges & Universities	1.67
<hr/> How Prepared Are Graduates to Meet Your Firm's Job Requirements <hr/>	
- Private Trade Schools	1.93
- Community College/Technical Institute	1.84
- 4-Year Colleges & Universities	1.85

\* 1 = Very Responsive      3 = Seldom Responsive

# Appendix C

## 46 FIRMS WITH 100 OR MORE EMPLOYEES

All Employees	2002	Forecast In 5 Years	Percent Change
1. Number of All Employees	29,700	32,088	8.04%
2. Number of ALL Employees Now Taking Academic Credit Courses	3,487		
3. Number of All Employees You Feel Should Be Taking Academic Courses	6,369		
4. Number of Those Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program:	668		
5. Education/Training Budget *	\$4,018,301	\$5,447,884	35.58%
Amount of Training Budget for: **			
b. Internally Provided Training Programs	\$ 678,841	\$1,218,238	79.46%
b. External Seminars & Workshops	\$ 869,241	\$1,226,939	41.15%
c. Industry Certificates	\$ 688,090	\$1,027,517	49.33%
d. Tuition & Cost for College Courses	\$ 168,675	\$ 380,736	125.72%
e. Other	\$ 125,000	\$ 106,000	-15.20%
<b>Information Technology Employees</b>			
6. Number of Information Technology Employees	1,607	1,681	4.60%
7. Number of Information Technology Employees Now Taking Academic Credit Courses	161		
8. Number of Information Technology Employees You Feel Should be Taking Academic Courses	667		
9. Number of Those IT Employees Taking Academic Credit Courses Who Are On a Company Tuition Reimbursement Program	54		
10. Number of Information Technology Employees Now Taking Industrial Certification Courses	105		
11. Education/Training Budget - IT Employees Only	\$1,693,663	\$1,863,100	10.00%

\* 25 of the 46 firms provided education/training budget information.

\*\* 30 of the 46 firms provided information on the amounts of their training budget for items 5a-5e. Therefore, training budget items 5a-5e do not equal the total training budget.

## Appendix C

### PROFILE OF ACADEMIC DISCIPLINES FOR INFORMATION TECHNOLOGY EMPLOYEES 46 FIRMS WITH 100 OR MORE EMPLOYEES

#### Estimated Percent of Employees by Academic Disciplines

ACADEMIC DISCIPLINES	Rank Importance of Discipline to Your Firm*	% IT Employees with these Disciplines 2002	% Employees with these Disciplines in 5 yrs
Electronic Engineering	2.55	4.85	4.98
Telecommunications	1.63	6.82	7.54
Systems Integration	1.29	12.16	13.39
Computer Engineering & Systems	1.90	7.56	8.05
Systems Development & Business Integration	1.65	28.67	24.73
Technology Management	1.81	10.51	9.73
Technical Marketing	3.12	3.45	4.02
E-commerce	1.92	9.53	10.76
Networking (LAN/WAN/IP)	1.17	11.83	12.59
	% Sub - Baccalaureate	33.96	27.54
	% Baccalaureate	58.96	63.14
	% Graduate	7.08	9.32

#### Estimated Number of Employees by Academic Disciplines

ACADEMIC DISCIPLINES	Rank Importance of Discipline to Your Firm*	# IT Employees with these Disciplines 2002	# Employees with these Disciplines in 5 yrs	Percent Change
Electronic Engineering	2.55	78	84	7.40
Telecommunications	1.63	110	127	15.64
Systems Integration	1.29	195	225	15.22
Computer Engineering & Systems	1.90	121	135	11.41
Systems Development & Business Integration	1.65	461	416	-9.76
Technology Management	1.81	169	164	-3.18
Technical Marketing	3.12	55	68	22.02
E-commerce	1.92	153	181	18.08
Networking (LAN/WAN/IP)	1.17	190	212	11.30
	# Sub - Baccalaureate	546	463	-15.20
	# Baccalaureate	947	1061	12.04
	# Graduate	114	157	37.72

\* 1 = Most Important 4 = Least Important

## Appendix C

### IMPORTANCE OF APPLIED AREAS 46 FIRMS WITH 100 OR MORE EMPLOYEES

Rank Each Applied Area	*Rank of Area	**Need Met by Colleges & Univs	*** Differences
<b>Electronic Engineering</b>			
- Computer Systems/Architecture	2.47	2.35	-0.12
- Directories, Circuits & Systems	3.02	1.95	-1.07
- Comm's, Control & Signal Processing	2.91	2.01	-0.90
- Other			
<b>Telecommunications</b>			
- Protocols, ATM, TCP/IP, Frame Relay, ADSL	1.25	3.11	1.86
- Wireless	2.21	3.50	1.29
- Telephony	1.69	3.06	1.37
- Fiber Optics	1.72	3.00	1.28
- Other			
<b>Systems Integration</b>			
- Software/Hardware Configuration	1.63	2.93	1.30
- LAN/WAN	1.27	2.93	1.66
- Technical Purchasing (RFI, RFP, ROI)	2.67	3.00	0.33
- Applied Mfg, Production, Operations	3.41	2.43	-0.98
- Installation/Implementation	2.39	2.69	0.30
- Quality Assurance	2.27	3.22	0.95
- Other			
<b>Computer Engineering &amp; Systems</b>			
- Operating Systems/Compilers/Tools	2.10	2.65	0.55
- Language/CASE	2.05	1.60	-0.45
- AI/ES/Inference Engines	3.12	2.74	-0.38
- Architectures/Platforms	1.58	2.91	1.33
- Capacity and Performance Planning	1.85	3.24	1.39
- Numerical Computing, Algorithms	2.93	2.13	-0.80
- Operations Research	2.75	3.06	0.31
- Standards/Documentation	1.57	2.76	1.19
- Other			
<b>Systems Development &amp; Business Integration</b>			
- Methodology	1.88	3.15	1.27
- Data Warehousing	1.65	2.84	1.19
- Client/Server	1.72	2.20	0.48
- Business Planning/Re-Engineering	2.09	3.18	1.09
- Human Factors Engineering	2.20	3.27	1.07
- Design/Programming	1.32	2.26	0.94
- Decision Support Systems	1.70	2.80	1.10
- Other			
<b>Technology Management</b>			
- Project Management	1.77	2.94	1.17
- Business Planning Strategies/Tactics	2.14	3.27	1.13
- Specific Technical Competencies	2.15	3.23	1.08
- Communications Law, Regulation	2.13	2.98	0.85
- Legal/Ethical/Human Resource Mgmt.	2.01	2.48	0.47
- Technology & Social/Economic Change	2.05	2.45	0.40
- Other			

\*1 = Most Important    4 = Least Important

\*\*1 = Meets Needs    4 = Does Not Meet Needs

\*\*\* A positive value suggests needs are not being met. A negative value suggests needs are being met.

## Appendix C

### IMPORTANCE OF APPLIED AREAS 46 FIRMS WITH 100 OR MORE EMPLOYEES (Continued)

Rank Each Applied Area	*Rank of Area	**Need Met by Colleges & Univs	*** Differences
<b>Technical Marketing</b>			
- Business Planning, Strategies, Tools	2.59	2.73	0.14
- Technical Competencies	2.53	2.20	-0.33
- Marketing Concepts	2.73	2.23	-0.50
- Other			
<b>E-commerce</b>			
- Development Technologies	1.66	2.25	0.59
- Legal/Public Policy Issues	2.23	2.82	0.59
- Business Opportunity/Risk	2.26	2.87	0.61
- Management & Control	2.04	2.76	0.72
- Security	1.27	3.26	1.99
- Other			
<b>Networking (LAN/WAN/IP)</b>			
- Protocols - Open and Proprietary	1.87	2.29	0.42
- Integration	1.54	3.19	1.65
- Convergence	1.52	3.27	1.75
- Servers, Bridges, Routers and Hubs	1.27	3.23	1.96
- Security, Encryption, Firewalls	1.22	3.41	2.19
- Continuity, Interruption & Recovery	1.21	3.49	2.28
- Other			
<b>Overall Average</b>	<b>2.03</b>	<b>2.80</b>	<b>0.77</b>

\*1 = Most Important    4 = Least Important

\*\*1 = Meets Needs    4 = Does Not Meet Needs

\*\*\* A positive value suggests needs are not being met. A negative value suggests needs are being met.

## Appendix C

### RANKING\* OF TECHNOLOGY AREAS 46 FIRMS WITH 100 OR MORE EMPLOYEES

Technology Areas	Rank*	
	2002	In 5 Years
- Languages	2.15	2.11
- Data	1.61	1.22
- Telecommunications	1.32	1.29
- Client/Server	1.96	1.34
- Human Factors Engineering	2.31	1.89
- Educational Technologies/Learning Services	2.39	2.53
- E-commerce	1.75	1.98
- CAD/CAM/CAE	2.92	2.64
- Object-Oriented Design	2.06	2.34
- Artificial Intelligence	3.16	2.50
- Multimedia - The Technologies	2.53	2.14
- Multimedia – The Presentation	2.32	2.41
- Virtual Reality	3.21	3.11

\* 1 = Most Important 4 = Least Important

# Appendix C

## IT CERTIFICATIONS 46 FIRMS WITH 100 OR MORE EMPLOYEES

Rank Each Certification	*Rank	
	2002	5 Years
<b>Vendor Certifications</b>		
- Microsoft	3.00	2.48
- Novell	3.60	3.49
- Lotus Notes	3.78	3.69
- Cisco	2.94	2.48
- Oracle	3.23	2.82
- PeopleSoft	3.91	3.79
- Linux	3.74	3.34
- Other		
<b>Technologies</b>		
- WAN/LAN	2.05	1.85
- TCP/IP	2.04	1.86
- VPN	2.93	1.88
- Wireless	2.74	1.79
- Other		
<b>Professional/Other</b>		
- Project Management (PPM)	2.64	1.13
- Security (SANS/ CISSP)	2.20	2.14
- Disaster Planning & Recovery	2.61	2.14
- A+	2.73	2.81
- Net+	3.14	3.16
- Other		
<b>Programming &amp; Development</b>		
- XML	3.54	3.07
- Java/ JavaScript	3.48	2.78
- HTML	3.16	2.70
- C++	3.30	3.06
- Visual Basic	3.44	3.05
- Other		
<b>Database</b>		
- Oracle	2.41	2.20
- SQL	2.20	2.13
- MS-SQL	2.80	2.62
- SQL Server	2.64	2.64
- DB2	2.83	2.41
- Crystal Reports	3.49	3.33
- Other		

\*1 = Most Important    4 = Least Important

# Appendix C

## COLLEGE RESPONSIVENESS TO FIRMS' NEEDS 46 FIRMS WITH 100 OR MORE EMPLOYEES

	*Rank of Area
<hr/> Rank Responsiveness of Area Initiatives in Meeting Your Firm's Educational Needs in IT <hr/>	
- Private Trade Schools	2.31
- Community College/Technical Institute	1.76
- 4-Year Colleges & Universities	1.83
<hr/> How Prepared Are Graduates to Meet Your Firm's Job Requirements <hr/>	
- Private Trade Schools	1.88
- Community College/Technical Institute	1.78
- 4-Year Colleges & Universities	1.81

\* 1 = Very Responsive      3 = Seldom Responsive