

A Vision for Information Technology and Engineering Education

A report compiled by the
Applied Information Management Institute



Executive Summary

The nature and character of greater Omaha business is changing.

To a large extent, Omaha business is being redefined around information and engineering disciplines. These developments have placed a significant demand for a workforce with unique skills, but the response from academic institutions has been slower than the changes in business and industry, leading to a mismatch in labor availability and demand.

During the summer and fall of 1995, the AIM Institute completed two major studies concerning greater Omaha business requirements for education services in information technologies and engineering. These studies were conducted in cooperation with numerous business leaders and over 100 firms with total greater Omaha employment exceeding 64,500 including over 8,700 information technology (IT) and engineering professionals.

The study documented that:

- Information technologies are dramatically changing because of the rapid convergence of various disciplines. In addition, the convergence of information technologies and engineering disciplines is accelerating.
- Growth in both IT and engineering employment exceeds the growth of all other employees.
- The gap between the available supply of new job entrants and professional positions is a chronic problem.
- Many desired engineering programs simply are not available locally.
- Training budgets allocated to IT and engineers are larger and growing rapidly when compared to growth in both employment and total training budgets.
- Engineering and IT firms both believe over 20% of their professional staff should be taking academic credit courses compared to 9% now taking those courses.
- Area academic institutions' offerings were judged as poor by respondents when asked how well "needs are met by colleges and universities" – particularly for programs and curriculum in the highest demand.
- There is no local Ph.D. program in any IT or engineering discipline.

Business response to the very tight professional labor supply and the lack of academic programs have included:

- Development of aggressive tuition reimbursement programs, national recruiting programs, and community initiatives like the Labor Availability Task Force and AIM's Omaha CareerLink;
- Relocating divisions to other cities;
- Failure to relocate other departments to Omaha;
- Starting new business functions in other cities;
- Difficulty in attracting new firms from outside the region;
- Local "salary wars";
- Other choices for educational services, including National Technological University.

Center of Excellence – A Vision

A New Vision

The remedy must include a new vision for the delivery of engineering and information technology education. Figure 1 captures part of that vision through a new Center of Excellence.

This vision must include:

- Service to traditional markets while anticipating the change and convergence in the disciplines taught;
- Response to professional requirements and physical location of students;
- Unique new business partnerships to assure relevancy and support.

Attributes of this program must include:

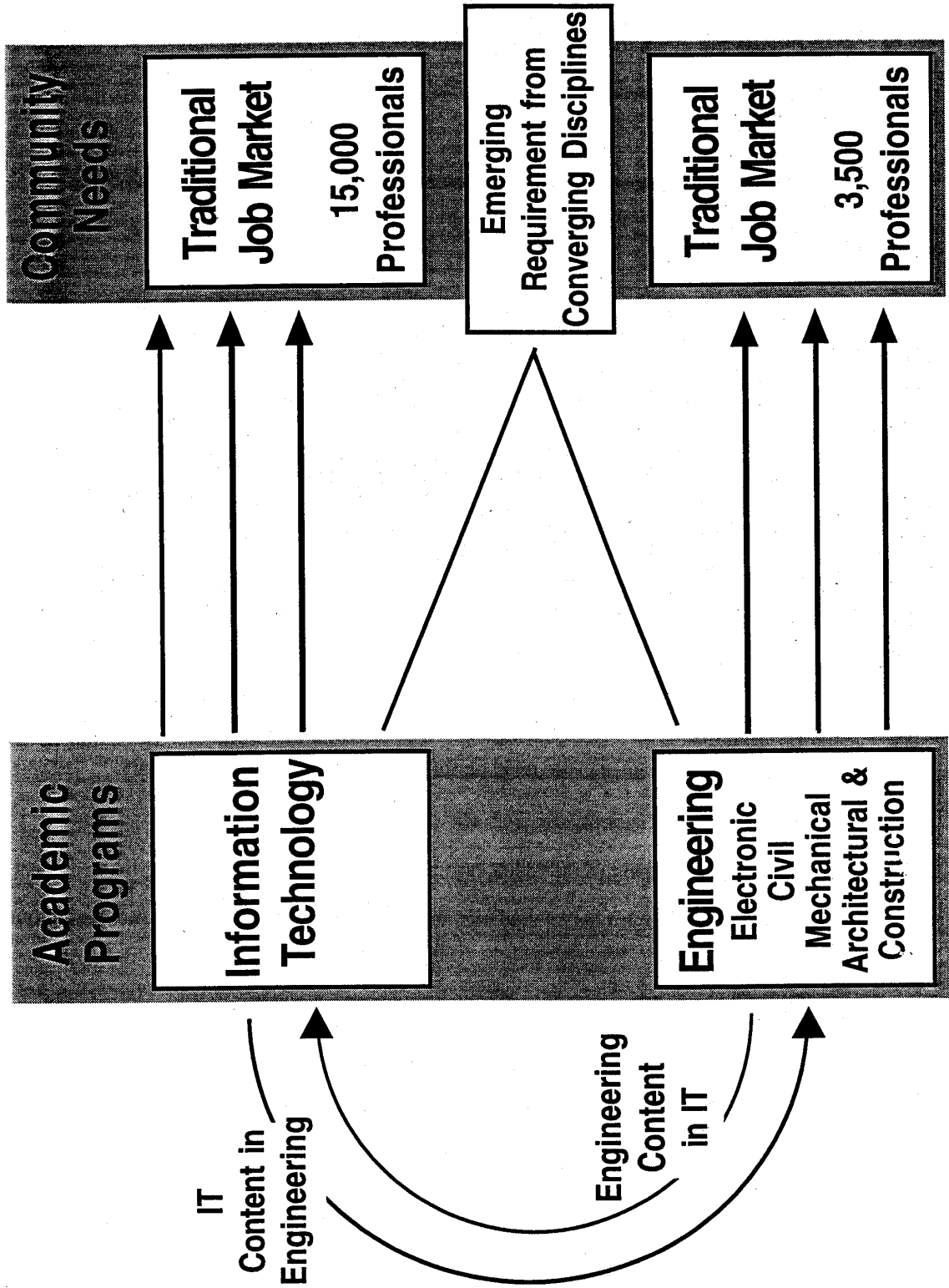
- A market driven culture.
- A culture that is fluid, driven by changing technologies and expectations.
- An organization that believes rapid change is the norm and builds to accommodate that change.
- A culture with timely decision making about curriculum, content, and delivery.
- Maintenance of the highest academic standards

Implementation of such a vision would result in a:

- Program with sufficient mass of students, faculty and resources to assure academic quality and success.
- Program with sufficient mass for a variety of unique partnerships between business and the university.
- Refocus of academic programs and faculty to coincide with regional and global business trends.
- Opportunity for academic leadership that will attract the best faculty.
- Relevant opportunity for academic choice by present and future students.
- Energized academic/business environment that positions both communities for their respective competitive environments.

The nature and character of greater Omaha business is changing. In earlier periods, Omaha business was dominated by meatpacking and food processing. Omaha later became known as an insurance town. Today, these industries are significant. They are also using information technologies to a greater extent than ever before. In addition, several Omaha start-up companies have grown to national prominence in a variety of information technologies. Omaha is a leader for in-bound and out-bound telemarketing as well as the reservation site for several national organizations; transaction processing defines several major businesses; there are numerous smaller software development and multimedia firms; a national list and directory service started in Omaha; and area firms electronically market their products and services internationally.

Figure 1
Information Technology and Engineering Center of Excellence



To a large extent, Omaha is being redefined around information and engineering disciplines. Figure 2 illustrates this development based upon the industry groups that have experienced the greatest growth in a recent five-year period.

These developments have placed a significant demand for a workforce with unique skills. It is reasonable to expect that area colleges and universities would respond with the curriculum and courses to help develop that trained workforce. The response has been slower than the changes in business and industry, leading to a mismatch in labor availability and demand. Expectations of business seem to be different than for the academy at large.

During the summer and fall of 1995, the AIM Institute completed two major studies concerning greater Omaha business requirements for education services in information technologies and engineering. These studies were conducted in cooperation with numerous business leaders and over 100 firms. Total metropolitan area employment by the participating firms exceeded 64,500 with over 8,700 information technology (IT) and engineering professionals. The total employment survey respondents are 17.2% of the greater Omaha MSA non-farm employment.

While there are some unique business requirements for educational services between these two industry groups, there is a surprising broad-array similarity.

The following is a summary of the findings from these two different studies with some observations about opportunities and synergies that present themselves when both studies are viewed together.

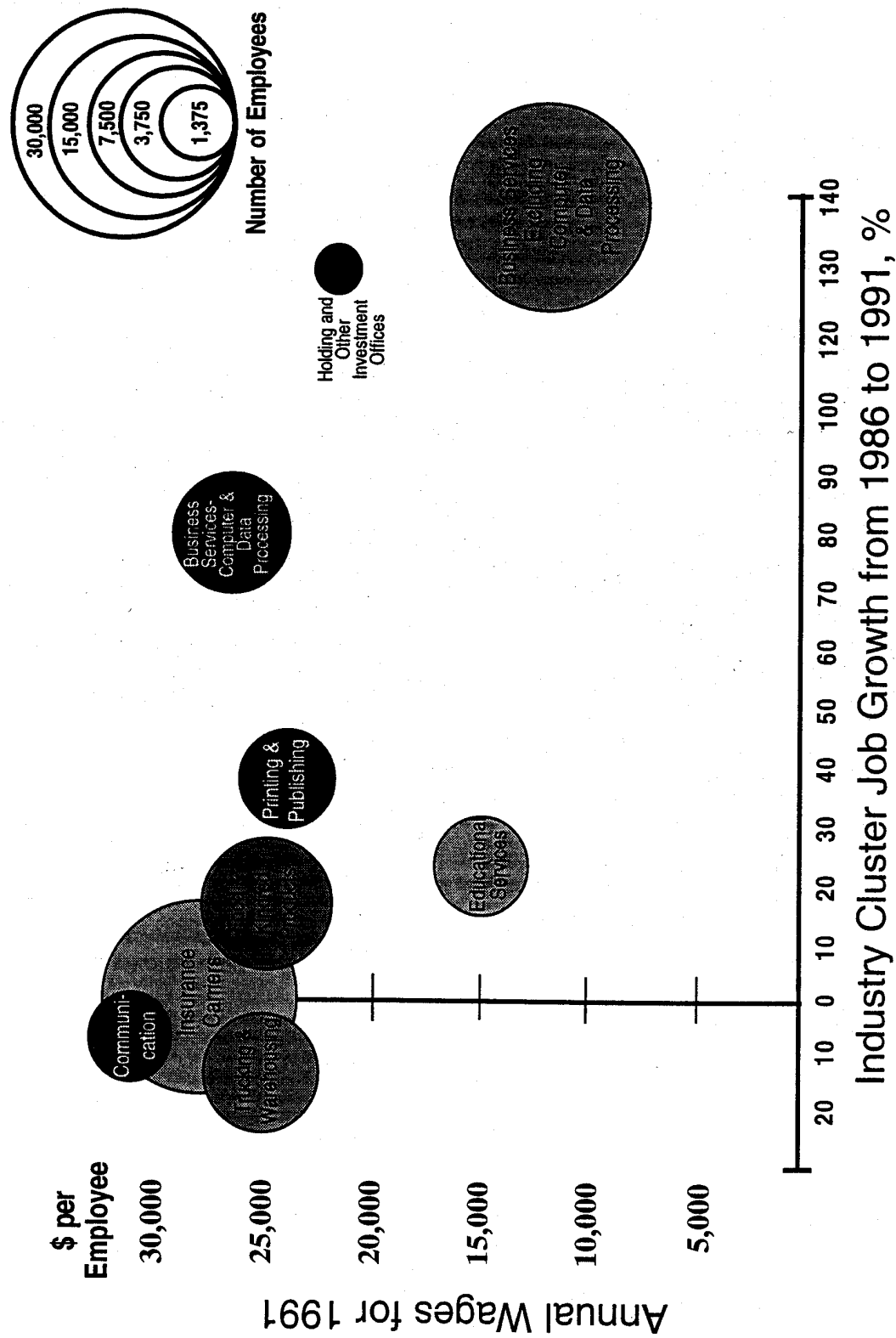
Composite Findings

1. Demands for Professionals and Educational Services

The growth in both IT and engineering employment exceeds the growth of all other employees.

Projected Five-Year Growth in Employment		
	Engineering Companies	IT Companies
All Employees	22.9%	10.4%
Engineering & IT Professionals	25.3%	26.9%

Figure 2
Employment Landscape, Omaha, Nebraska



Source: SRI, Greater Omaha Chamber of Commerce

Total training budgets over the next five years for both IT and engineering firms will grow at rates that exceed growth in total employment.

Projected Five-Year Growth in Training Budgets		
	Engineering Companies	IT Companies
Total Education & Training Budgets	27.2%	50.5%
Training Budget for Engineering & IT Professionals	41.4%	59.7%

Training budgets per IT and engineering employee are larger and growing rapidly when compared to growth in both employment and total training budgets.

Training Budgets Per Employee		
	Engineering Companies	IT Companies
For All Employees		
1995	\$ 659	\$ 742
In Five Years	\$ 770	\$1,015
For All Employees		
1995	\$1,359	\$1,382
In Five Years	\$1,617	\$1,761

There is an increasing demand for continuing education.

For engineers, that demand is driven by rapid change in core technologies, industry trends toward increased requirements for professional registration, annual renewal of licenses, and increased quality requirements for general continuing education programs.

For IT professionals, that demand is driven by continued rapid change in core technologies and processes required to remain professionally competent.

All Employees		
	Engineering Companies	IT Companies
Currently Taking courses for Credit	7.8%	8.0%
% on Tuition Reimbursement Programs	70%	70%
% Employees You Feel Should be Taking Academic Courses	19.7%	10.5%

Engineering and IT firms both believe over 20% of their professional staff should be taking academic credit courses. Currently, less than 10% of engineering and IT professionals are now taking academic courses for credit.

Engineering and IT Professional Employments Currently		
	Engineering Companies	IT Companies
Currently Taking courses for Credit	9.5%	9.8%
% on Tuition Reimbursement Programs	95%	75%
% Employees You Feel Should be Taking Academic Courses	21.5%	20.9%

95% of engineers and 75% of IT professionals now taking courses for academic credit are on tuition reimbursement programs.

There is a large gap between the available supply of new job entrants to fill professional positions, particularly for IT professionals, and the projected annual growth required by greater Omaha area firms.

There is a measurable demand for locally provided graduate degree programs.

For IT, there is a unique demand for educational services targeted toward the 58% of the information processing professional labor force with sub-baccalaureate degrees.

2. Academic Programs and Courses

There are surprising consistencies between the two studies in several other important categories.

In both studies, area academic institutions' offerings were judged as poor by respondents when asked how well "needs are met by colleges and universities." This was particularly true for Academic Disciplines and Applied Areas ranked highest by the respondents.

For IT, there are numerous local programs available from the certificate level through masters degrees, but the content is frequently inconsistent with employers' needs.

For engineering, many desired programs simply are not available locally. Courses offered by satellite are viewed as a poor second choice.

There is no local Ph.D. program for either IT or engineering.

Information technology was a high-priority academic discipline for engineering firms.

3. Corporate Response

The surveys and other external data document the response of business to the very tight professional labor supply. They also document the demand for academic programs that develop new entrants to the job market and career training choices for current employees.

Firms have developed aggressive tuition reimbursement programs to encourage employees.

Recruiting programs targeting other universities and non-regional job markets are gaining momentum. Community initiatives like the Labor Availability Task Force and AIM's Omaha CareerLink are increasingly being used to reach external labor markets.

Business growth requirements are sometimes met by:

- relocating divisions to other cities;
- failure to relocate other departments to Omaha;
- starting new business functions in other cities
- difficulty in attracting new firms from outside the region.

Local competitive forces often result in "salary wars."

Internships are increasingly being used as a recruiting strategy.

Some job applicants from other regions reject offers because of a lack of educational opportunities.

Other choices for educational services are being considered including National Technological University, which offers over a dozen technical masters degrees delivered via satellite with classes taught from over fifty major U.S. universities.

4. Convergence of Disciplines

There is a rapid convergence of various disciplines creating current information technologies platforms. This convergence of computer, voice communications, data communications, video, image, etc., is well documented. In addition, information technologies are converging with many engineering disciplines at accelerating rates. The following excerpt from the IT and engineering studies partly illustrates the breadth and scope of these trends.

For Engineering:

- *Computers and related information technologies are becoming increasingly important to the practice of engineering. Computer-aided design and modeling technologies place increased training and skill requirements on practicing engineers from all disciplines.*
- *Information technologies are increasingly being designed into structures, devices and processes. Structures such as medical facilities, schools and business are being redesigned around present and future capabilities of information technologies. At a minimum, wiring and other physical needs of information technology must be designed into new structures. More important, however; is the increasing demand for*

“smart” structures and devices will accelerate the demand for electric engineering/computer skills.

- *Classic business users of information technologies also have an increasing demand for personnel rooted in electrical engineering/computers. In colleges and universities across the country, the intellectual roots for information technology curriculums are frequently found in three Colleges:
 - *Engineering*
 - *Business Administration*
 - *Liberal Arts (usually the Math Department)**

In the Omaha metropolitan area, most academic programs for information technology have a strong business or liberal arts heritage.

Electronic engineering-based computer courses or programs are generally not available at area colleges or universities.

For Information Technology:

The much-discussed convergence of IT disciplines is well documented and accelerating. The integration of converging technologies takes place at two applied levels:

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

The survey’s Academic Discipline called Systems Integration captures the essence of that integration across multiple technologies. This activity consumes increasing amounts of corporate-energy but no organized academic disciplines exist in Omaha postsecondary institutions (or anywhere in the U.S.) around this topic. Further; the survey results assigned high rank to many technical disciplines that are now available in the community. Business seems to be saying we need engineering disciplines in academic programs even though we will need only modest numbers of electronic engineers.

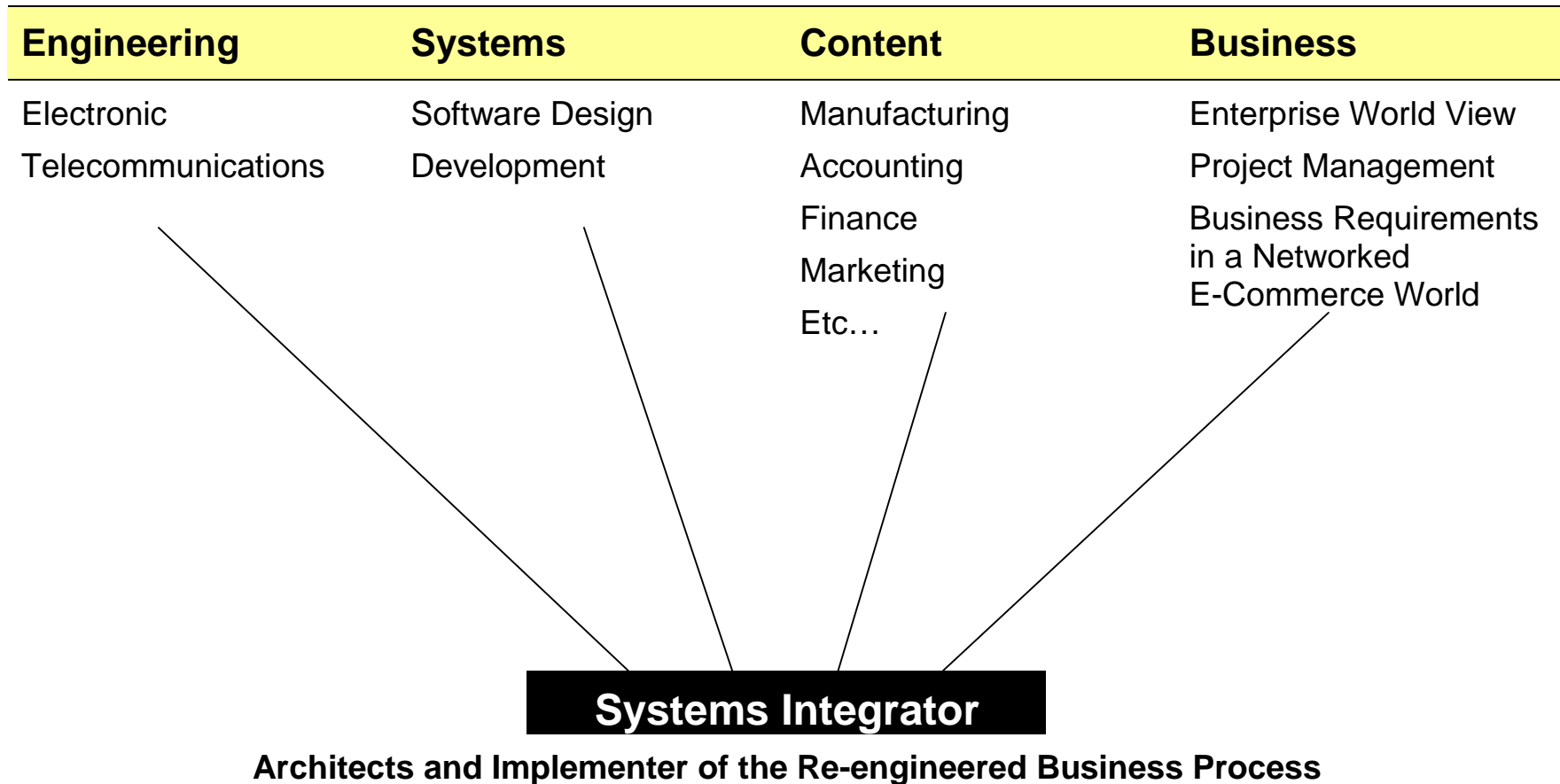
Figure 2 illustrates an emerging professional position. Business needs Electronic Engineering disciplines that are integrated with other disciplines to meet the rapidly growing requirements for technical skills and a business perspective.

Meanwhile, much of the Omaha business community has a strong telecommunications requirement. Local industries with global markets have capitalized on the strong local telecommunications infrastructure. The virtual absence of strong baccalaureate and graduate programs in telecommunications suggests that college and university courses and programs have significantly lagged community demand.

Figure 3

An Emerging Employee: “The Systems Integrator”

Intellectual Roots:



5. What Does it All Mean?

Within the university, frequently, academic colleges and departmental programs are defined as separate disciplines. At the risk of over-simplification, MIS programs in the College of Business view computer technologies from a business perspective. In the College of Arts and Sciences, it is viewed from a mathematical and scientific perspective. While in the engineering school, it is viewed from a chip/electronic device perspective. The application view is defined by the finance, marketing, accounting, and other departments.

Likewise, engineering has numerous programs that share core math and engineering concept courses but students graduate with relatively narrow academic credentials.

Meanwhile, in the business world, these disciplines are converging at accelerating rates. As corporate America has downsized and right-sized firms, managers and professionals are a given broader span of control over all business processes. Re-engineering business processes require skills across a broader array of disciplines than ever before. Also, the “mean time” to market for new goods, services, or process change has shortened dramatically as technology and innovation drives today’s global business processes.

The result: today’s academic community structure matches the business community of twenty years ago; and its deliberate business processes and academic structures frequently prohibit achieving the change rates required by its business customers.

A New Vision

What is required is a new vision for the delivery of academic services in engineering and information technologies. This vision must include the ability to service traditional markets while anticipating the change and convergence that is underway in the very disciplines to be taught. The vision must also include new business partnerships to assure relevancy and support, plus the physical location and professional requirements of students.

Figure 1 might describe a new Center of Excellence. Other attributes of this Center must include a culture that is fluid, driven by changing technologies and expectations – an organization that believes rapid change is the norm and builds to accommodate that change. An outline might include:

- A virtual Center that can acquire faculty resources from across the campus, other State universities and colleges, adjunct faculty and other universities.
- Disciplines including the information technology departments in the College of Business, Arts and Sciences and other related departments. It would also include Electronic Engineering and Communication disciplines that might be developed by

- the College of Engineering. Disciplines from industrial psychology, education, art, music and others may also be integrated into the curriculum.
- Civil, Mechanical and Architectural/Construction engineering disciplines must also be included. While these disciplines define the current metropolitan area business needs, they are also the disciplines that are increasingly converging with information technologies.
 - A Center with access to external teaching resources such as the National Technological University, Internet, partnerships with other universities, etc. Today, most of the focus on distance learning is on the “export of our knowledge” to students. An “import” mentality to acquire knowledge and professional skills must be developed to significantly enrich the breadth and depth of curriculum offerings.
 - A culture of timely decision making about curriculum, content and delivery is essential. Re- engineering processes that lead to flat organizations with sufficient span-of-control to deliver rapid development cycles of curriculum and programs will be a challenge.
 - High academic standards. Erosion of academic standards will not serve the university, the students, or their employers.

If the vision is effective and timely implemented, it would result in a:

- program with sufficient academic mass of students, faculty and resources to assure academic quality and success;
- program with sufficient mass for a variety of unique partnerships between business and the university;
- refocus of academic programs and faculty to coincide with regional and global trends;
- opportunity for academic leadership that will attract the best faculty;
- relevant opportunity for academic choice for present and future students;
- energized academic/business environment that positions both communities for their respective competitive environments.