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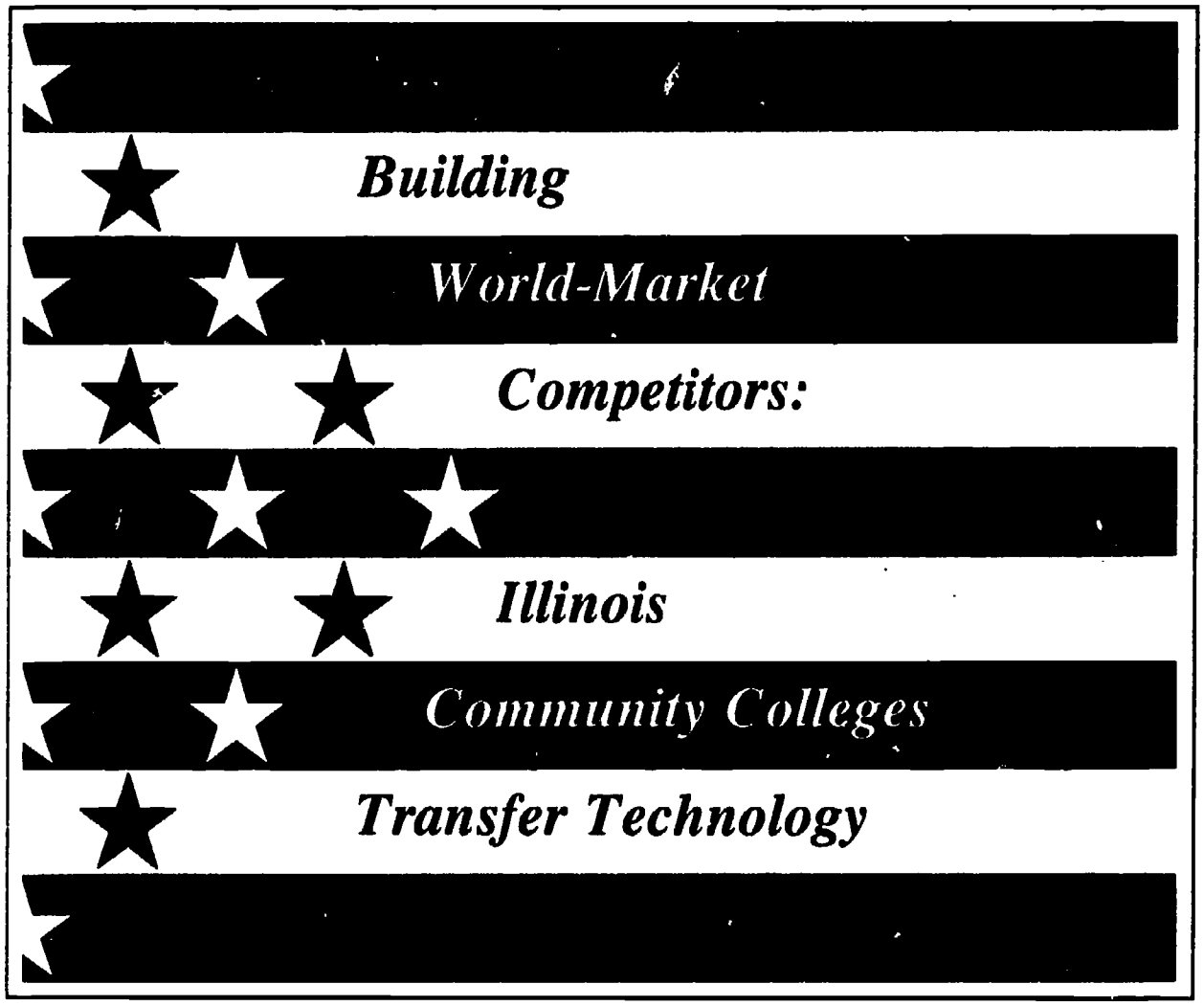
ABSTRACT

In 1990, the Illinois Council of Public Community College Presidents (ICPCCP) commissioned a survey to document the current capacity and future potential of the Illinois Community College System (ICCS) to provide technology transfer assistance to the commercial marketplace and the public sector. An extensive questionnaire was developed and mailed to all 45 chief executive officers (CEOs) systemwide to obtain information related to technology transfer programs, policies, and resources. Key findings, based on a 93% response rate, included the following: (1) nearly all responding colleges offered a wide range of technology transfer products and services, such as technical assistance with current technologies; information and resources for small businesses, entrepreneurs, and inventors; and customized contract training; (2) a majority of the colleges had formed partnerships with government, business and industry, and/or other educational institutions to facilitate technology transfer; (3) over 75% of the colleges reported that local business and industry had additional technology transfer needs in such areas as basic skills enhancement and advanced manufacturing technology training; (4) over one-half of the colleges regularly evaluated technology transfer programs through informal communications, surveys, or interviews; and (5) over 80% of the colleges provided salary supplements or stipends to full-time faculty participating in technology transfer efforts. Based on survey findings, the ICPCCP offered five recommendations, concerning college and systemwide administrative policies, partnerships, funding, faculty development, and formal evaluation, for the advancement of the ICCS's technology transfer function. (JMC)



1990 Status Report

Debra D. Bragg

Supported by
The Illinois Council of Public Community College Presidents
and
The Illinois Council on Vocational Education

October 1990

Building World-Market Competitors:

Technology Transfer and the Illinois Community College System

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Foreword

For almost ten years Illinois' community colleges have increased their focus on developing and providing trained human resources for their state's businesses. In response to the economic straits of the early 1980s, individual colleges cultivated resources and know-how and brought significant economic relief to their local districts. However, the colleges' power and potential to introduce technology and prepare the workforce remains largely unrealized. This report has been generated by a genuine need for Illinois to understand and grasp an indispensable resource required to lift her commerce to a level of competitiveness in the world marketplace. A product of the Illinois Council of Public Community College Presidents' Committee on Advanced Technology and Economic Development, this report provides solid evidence of the colleges' capabilities. It will be presented to state leaders in both business and government to demonstrate this resource and to promote increased use of the colleges in the state's business and economic development.

Acknowledgements and special thanks are to be given to members of the staff of the Illinois Community College Board, especially Ms. Lynn Tolle Burger, for advice and information during the project design; to Mr. Peter Johnson and the Illinois Council for Vocational Education for funding assistance; to members of the Presidents' Council's Committee on Advanced Technology and Economic Development, especially Dr. Herb Lyon, Chancellor of Black Hawk College, for support and advice; to the University of Illinois' Office of Community College Research and Leadership funded through a grant by the Illinois State Board of Education, Department of Adult, Vocational and Technical Education for undertaking this project; to Dr. Debra Bragg, Director of the Office of Community College Research and Leadership and her assistant, Ms. Rita Fischbach, for project management, design and analysis, and for generating this report; and to Mr. Russ Hamm, Dean of Instruction at the College of Lake County, for project design assistance and staff support.

September 1990

Daniel J. LaVista, Ph.D.
Chair, Committee on Advanced Technology
and Economic Development,
Illinois Council of Public Community College Presidents

Executive Summary

During the decade of the 1980s, the Illinois community college system became increasingly involved in economic development with the state's private and public employers. Currently, the Illinois community colleges provide a foundation for economic development initiatives throughout the state through well-developed business assistance centers, information databases, resource networks, customized contract training services, advanced occupational and technical curricula, and knowledgeable leadership. Through the extensive economic development products and services of community colleges, many of Illinois' businesses and industries are served.

During 1990, the Illinois Council of Public Community College Presidents commissioned a survey project to document the capabilities of the Illinois community college system to provide technology transfer assistance to the commercial marketplace and public sector. The project involved designing and mailing an extensive questionnaire to the Chief Executive Officers (CEOs) of all of the Illinois community colleges to obtain information about technology transfer programs, policies and resources. Of the total sample of 45, 42 surveys (93%) were completed by the community colleges and analyzed to produce the survey findings.

Key Survey Findings

1. **Illinois community colleges offer a vast range of technology transfer products and services.** Nearly all of the Illinois community colleges provide a wide range of technology transfer products and services including the following:

- o Technical assistance with current technologies
- o Information and resources for small businesses
- o Information and resources for entrepreneurs and inventors
- o Troubleshooting and problem solving of technical applications
- o Strategic planning for local business and industry
- o Customized contract training and education
- o Demonstrations of technologies

Frequently the community colleges provide technology transfer directly through their own personnel, facilities and equipment. Additionally, most of the colleges broker technology transfer expertise and resources within local communities to maximize their ability to meet clients' needs. Within the wide range of technology transfer products offered by the colleges, advanced customized contract training and education in the areas of business, computers and engineering is very prevalent. All of the colleges deliver advanced customized technical training on their own campuses or at local employers' facilities.

2. **A variety of methods is used by the community colleges to promote technology transfer.** At least six promotional methods are used by the community colleges to initiate technology transfer activities including such proactive methods as solicitation, publicity/promotion and partnerships. The colleges also report initiating new technology transfer activity by responding to requests and referrals from business and industry, labor organizations, and college personnel and students.

3. **Illinois community colleges serve a wide range of private and public clients.** Illinois' community college system serve a wide range of clients seeking technology transfer including

private manufacturing and nonmanufacturing firms, public agencies, and individual entrepreneurs.

4. **Illinois community colleges form partnerships to facilitate technology transfer.** Community colleges are not alone in providing technology transfer programs in Illinois. Partnerships with other public and private organizations are plentiful. The majority of community colleges report partnering with private firms, government agencies, private consultants, professional organizations, four-year colleges and universities, private industry councils, and other community colleges to deliver technology transfer.

5. **CEOs promote technology transfer.** Illinois community college CEOs are important advocates for technology transfer. They demonstrate their commitment within the colleges by providing resources and setting policies to support technology transfer. Equally as important, CEOs promote technology transfer outside the colleges with trustees, local business and industry leaders, state policy makers, members of the General Assembly, and taxpayers.

6. **Business and industry seek additional technology transfer products from the Illinois community colleges.** Over three-fourths of the colleges report that local business and industry, particularly small and medium sized firms, have additional needs for technology transfer products and services. Six general areas identified by the colleges for future technology transfer programs are listed below:

- o Basic skills enhancement
- o Computers
- o Quality management and productivity improvement
- o Advanced manufacturing technologies
- o Advanced quality control and assurance
- o Human resource development

Local business and industry also tell the colleges they need to expand their technology transfer products and services in the following areas:

- o Needs assessments
- o Instructional design assistance
- o Technology assessments
- o Productivity assessments
- o Advanced technology demonstrations

7. **Illinois community colleges encounter some roadblocks in delivering technology transfer products.** Consistently, community colleges view themselves as capable of meeting business and industry demand for technology transfer with committed and capable leadership. It is within this context that community colleges identify improvement opportunities to continue to further develop their technology transfer programs. The findings point to the need to improve technology transfer through the following strategies:

- o Make business and industry more aware of community college technology transfer initiatives
- o Increase funding for technology transfer
- o Obtain more advanced technology equipment and facilities for technology transfer

8. **Economic development units along with many other college departments transfer technology.** Within the colleges, economic development units are focal points for technology transfer. Occupational and technical education departments play an important secondary role.

Other units that support the colleges' capabilities to provide technology transfer are adult/continuing education, central administration and academic departments.

9. **Internal evaluation results are used routinely to assess technology transfer.** Over one-half of the colleges regularly evaluate technology transfer programs by using informal communications and surveys or interviews. Nearly all of the colleges evaluate the costs, efficiency and effectiveness of technology transfer programs, products and services for their business and industry clients. Fewer of the colleges evaluate the benefits of technology transfer for their own personnel, facilities or students. The evaluations are usually conducted by internal personnel.

10. **Full-time faculty experts play an important role in transferring technology.** The colleges value full-time faculty involvement, as evidenced by over 80% providing salary supplements or stipends to faculty who participate in technology transfer. Further, the vast majority of colleges provide internal professional development, vendor training, tuition reimbursement for coursework, sabbatical leaves, or arranged leaves with business and industry to enhance the ability of faculty to contribute to technology transfer.

11. **Pricing policies for training associated with technology transfer reflect local fee structures.** The approaches community colleges take in pricing training associated with technology transfer vary greatly. Apparently colleges develop pricing formulas independent of one another in order to meet the needs of local clients. Total prices that colleges set for training are largely dependent upon fees assessed for instruction, administration and training development.

12. **Formal agreements and contracts are comprehensive and inclusive in scope.** Across the Illinois community college system, formal agreements and contracts for technology transfer contain items specifying partnerships, objectives, equipment, facilities, pricing and/or funding strategies, personnel, and outcomes.

Recommendations

In order for the Illinois community college system to meet the vast array of technology transfer needs of commercial firms and public-sector organizations, it is important to continue to build effective technology transfer products and services. At the same time, colleges need to develop new and innovative technology transfer initiatives to meet emerging needs. To ensure the success of future technology transfer endeavors, the following five recommendations are offered:

1. Ensure that college and state-wide administrative policies and processes support efficient and effective delivery of technology transfer
2. Continue to strengthen partnerships with other technology transfer providers
3. Ensure adequate funding levels for community college technology transfer products and services
4. Continue to develop the expertise of college faculty and explore incentives to involve more full-time faculty experts in technology transfer
5. Explore opportunities to evaluate technology transfer programs through on-going formal evaluation processes

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A copy of **Building World-Market Competitors: Technology Transfer and the Illinois Community College System, 1990 Status Report**, can be otained through your local public community college.

The Technology Transfer Survey: Introduction

During the decade of the 1980s, the Illinois community college system became increasingly sophisticated and productive in delivering economic development assistance, especially technology transfer, to business and industry throughout the state. Today, as we move into the 1990s and employers face more highly-competitive world markets, Illinois' community colleges demonstrate the capability to operate as a vital economic development support system. Technology transfer initiatives of the community colleges are designed to be responsive to local firms' needs to expand into new and highly-competitive enterprises. These initiatives involve well-developed business assistance centers, comprehensive databases, expansive resource networks, and qualified experts in applied technologies, business and economic development. This mix of leadership, resources and expertise makes the Illinois community college system a logical provider of technology transfer assistance throughout Illinois for the future.

Goals of the Survey

While the work of the Illinois community college system in technology transfer grows, relatively little is known about products and services generated by the colleges in this important economic development arena. To illuminate the capabilities of the Illinois community colleges to provide technology transfer assistance, the Illinois Council of Public Community College Presidents commissioned a comprehensive state-wide survey project. The primary purpose of the study was to capture a complete picture of the Illinois community college system's involvement in technology transfer. Two important goals of the survey were:

- To document the scope and diversity of technology transfer initiatives, products and services for private and public clients.
- To determine future directions for technology transfer initiatives of the Illinois community college system.

For the purposes of the state-wide survey, the following definition of technology transfer was used:

Technology transfer is the application of existing technology and new technological breakthroughs in the commercial marketplace. Technology transfer occurs when colleges assist firms to use technologies to operate at their full productive and competitive capacities. The activity should involve:

1. the use of community college personnel and resources directly via consulting, training or other related activities or indirectly via referrals to other experts and resources, and

2. the integration of existing or new technological products, processes or services into commercial operations in the marketplace.

The survey was undertaken by the Illinois Council of Public Community College Presidents' Advanced Technology and Economic Development committee under the leadership of Dr. Daniel J. LaVista, President of College of Lake County. (Members of the Committee on Advanced Technology and Economic Development are listed on page 29 of this report.)

Development of the Survey

In October 1989, the committee developed an initial list of questions for the survey. These items described the current status of technology transfer initiatives in the Illinois community college system and identified capabilities for future endeavors. The general topics identified for the survey are summarized below:

- o Products and services considered to be technology transfer
- o Facilities and equipment used for technology transfer
- o Formal relationships, partnerships and competition
- o Internal college processes and structures
- o Personnel involved in technology transfer
- o Full-time faculty involvement
- o Staff development and upgrading for technology transfer
- o Promotional and marketing plans and tools
- o Pricing policies
- o Roadblocks encountered in delivering technology transfer
- o CEO's role in building linkages to business and industry
- o College funding strategies
- o Description of databases maintained by colleges on local business and industry
- o Evaluation processes
- o Success stories

A special subcommittee designated by the Advanced Technology and Economic Development Committee refined and organized the topics into a mail survey. A draft of the survey was reviewed and approved at a January 1990 committee meeting. Members of the committee made a number of important recommendations for improving the survey and approved a field test. The five colleges taking part in the field test were:

- o Black Hawk College, Quad Cities and East campuses
- o Chicago City-Wide College
- o Danville Area Community College
- o Elgin Community College
- o John Wood Community College

Information provided by the field sites was extremely valuable in creating the final 40-page survey which was broken into three sections: General Technology Transfer Programs, Pricing of Technology Transfer, and Technology Transfer Resources. (The survey is not included in this report due to its length. A copy may be obtained by contacting the Office of Community College Research and Leadership, Department of Vocational and Technical Education, University of Illinois at Urbana-Champaign.)

The General Technology Transfer Programs section included 18 questions related to the scope and status of technology transfer programs offered in FY88, FY89 and currently. This section requested information regarding clients, partners and competitors; processes, personnel, procedures, and departmental assignments; roadblocks; and future plans.

The section on Pricing of Technology Transfer provided four specific cases illustrative of different types of training typically associated with technology transfer. The colleges were asked to indicate their total prices and the formulas used to calculate those prices.

The Technology Transfer Resources section requested that colleges identify three or more examples of advanced technology courses, workshops or seminars involving technology transfer during FY89 in the following areas:

- o Agriculture
- o Business
- o Computers, computer technology and information sciences
- o Engineering and engineering-related technologies
- o Health
- o Science technologies

The colleges also indicated staffing patterns, (i.e., full-time faculty, part-time faculty or outside contractors), facilities, equipment, and delivery methods (on-campus or in-plant) for training and education associated with technology transfer.

Distribution and Follow-up

The survey was mailed to the CEOs of 50 Illinois community college campuses, including the 5 field test sites, in March 1990. Once received by the CEOs, a team of faculty and administrators knowledgeable about technology transfer completed the survey. In early April, community colleges that failed to respond to the survey received follow-up postcards. Later in April and May, community colleges that had not participated in the survey received follow-up phone calls, along with a second copy of the survey. By June 1990, 46 of the 50 community college campuses involved in the original sample completed and returned the survey.

Based on the recommendations of two multiple-campus community-college districts that received several copies of the survey, some surveys were combined to create a comprehensive response for entire college districts. Further, a phone conversation with an administrator at one community college revealed that, while there was interest in assisting with the survey, too little technology transfer was underway to merit its completion. Therefore, the response rate was modified to 42 of a total sample of 45, 93%. (Illinois community colleges participating in the survey are listed on page 31 of this report.)

The Technology Transfer Survey: Key Findings

Key Finding 1: The Illinois community college system offers a vast range of technology transfer products and services.

The Illinois community college system offers a wide range of technology transfer products and services to the commercial marketplace and public sector. Table 1 identifies the extent to which the 42 Illinois community colleges responding to the survey offer various types of technology transfer products and services. The vast majority of colleges indicate they offer products and services in each of the 17 areas identified in the survey. The general types of technology transfer products and services offered by the colleges include the following:

- o Technical assistance with current technologies
- o Information and resources for small businesses
- o Information and resources for entrepreneurs and inventors
- o Troubleshooting and problem solving of technical applications
- o Strategic planning for local business and industry
- o Customized contract training and education
- o Demonstrations of technologies

All 42 of the colleges offer technology transfer products and services related to strategies for assessing local business and industry needs, occupational and technical education, customized technical training, and course development and design for business and industry. Direct methods are the prevalent means of delivering most technology transfer. Of the 17 products and services listed in the survey, all but 2, (i.e., strategies for developing, distributing or marketing new technologies and information about patents) are delivered more often by the personnel of the community colleges than through contracts or referrals with outside experts and agencies.

The colleges do not limit technology transfer assistance to their own resources. They frequently contract or partner with agencies and experts in their communities to provide technology transfer assistance. Over one-half of the colleges contract or partner to provide such products and services as the following:

- o Customized technical training
- o Customized managerial training
- o Information related to technology

Over one-half of the colleges refer businesses and industries who contact them for technology transfer services to experts outside of the colleges. Community colleges recognize that sometimes local experts and agencies are required to meet local firms' needs. In these circumstances, referrals are made by the colleges. The majority of colleges indicate they make referrals when local firms request assistance with current technology; strategies for creating small businesses; advice on relocating, expanding or retaining existing businesses; information for entrepreneurs; and information about technology and patents.

Table 1

Technology Transfer Products and Services Offered by the Illinois Community Colleges

Types of Products/Services	Number of Colleges Offering Products/Services n=42	Percentage of Colleges Technology Transfer Products Direct	Contract	Referrals
Strategies for assessing local business and industry needs	42	100%	41%	31%
Regular occupational and technical courses	42	100	50	26
Customized technical training	42	98	60	33
Course development for business and industry	42	88	41	31
Assistance with current technology	41	83	64	62
Strategies for creating small businesses	41	79	33	57
Information for entrepreneurs, inventors or small business owners	40	88	55	69
Strategies to relocate, expand or retrain business and industry	40	83	48	62
Information about technology	39	86	62	62
Customized managerial training	39	86	55	33
Information from databases about technologies	39	81	43	48
Development of solutions to technoiogy problems and issues	37	64	50	50
Demonstrations of technologies	37	64	38	45
Telecommunications applications for technical information and training	35	60	33	21
Troubleshooting of technical applications and problems	34	57	36	57
Strategies for developing, distributing or marketing new technologies	33	48	19	52
Information about patents	31	33	7	60

NOTE: The respondents could check any or all methods for offering each of the technology transfer products and services identified in the survey. Therefore, the rows may not add to 100%.

Technical Training and Consulting

Figure 1 shows the level of technology transfer occurring in Illinois community colleges during FY88 and FY89 in five specific areas:

- o In-plant customized or contract technical training delivered by college personnel
- o Customized technical training offered on campus
- o In-plant customized or contract training delivered by outside contractors
- o Consulting by college personnel about technical applications or technology problems
- o Referrals to outside agencies to deliver technology transfer products and services

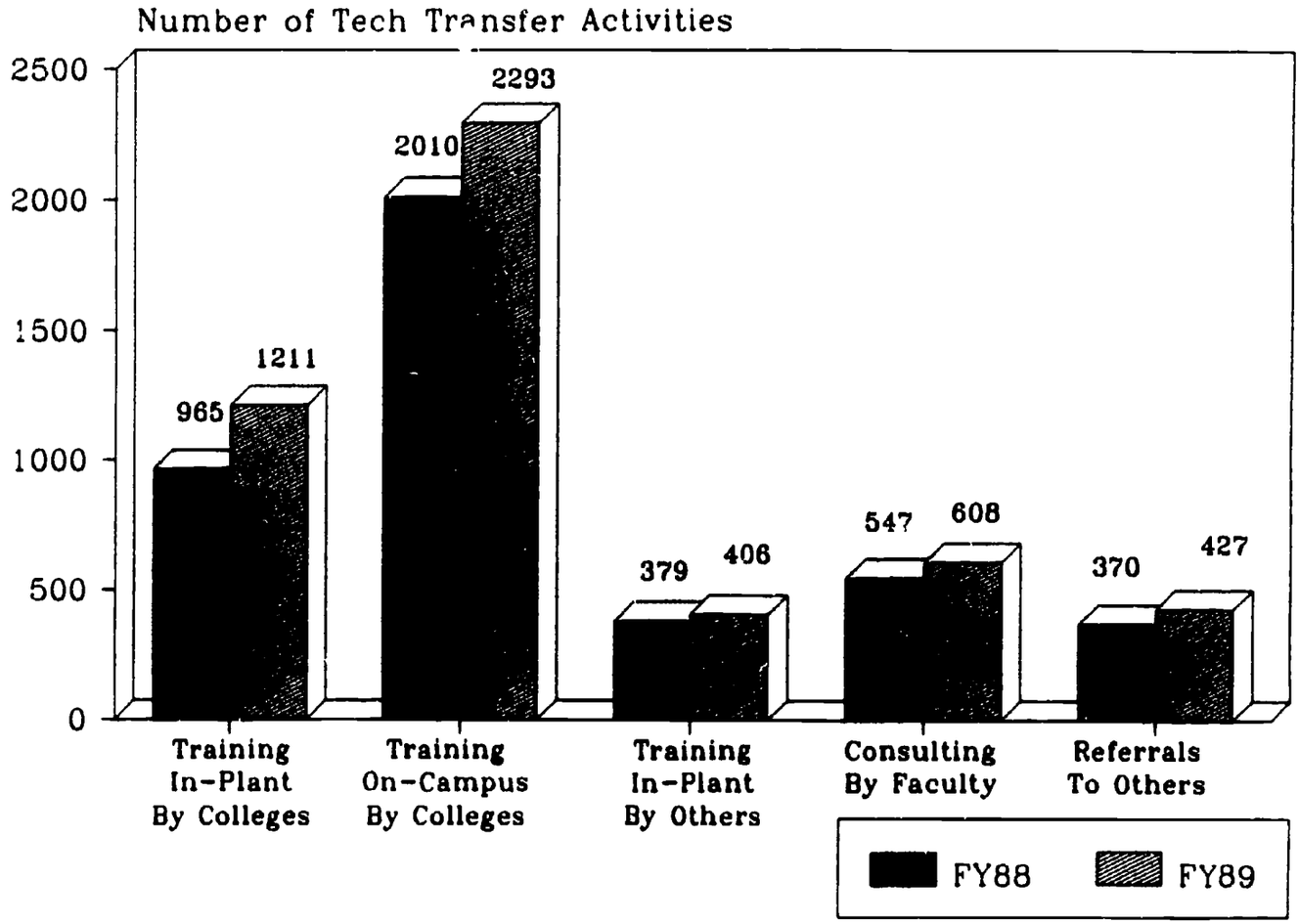

Figure 1. Technology Transfer and Consulting Offered by the Illinois Community Colleges During FY88 and FY89

Customized or contract technical training, especially that which was delivered on campus, was the most prevalent of the five types of technology transfer services offered by the colleges in FY88 and FY89. On average, each of the colleges offered approximately 90 customized training courses through various means during FY88. During FY89, the average increased to 97. ***This level of activity is equivalent to each college in the Illinois community college system offering 3 technical training courses for external clients nearly every week of the regular academic year.***

Figure 1 also indicates that the type of training that grew most between FY88 and FY89 was in-plant customized or contract training by college faculty or staff. There was a 25% increase in customized or contract in-plant training during this time period.

Further, the findings reveal that while the colleges undertake less activity in the areas of faculty consulting and referrals to outside experts, the activity is growing. Faculty consulting grew by 11% and referrals by 15% from FY88 to FY89. It should be noted that activity such as consulting is probably more difficult for the colleges to track than training courses simply because of the individualized nature of consulting. As a consequence, these statistics may understate the importance of consulting and referrals within the total spectrum of technology transfer.

Advanced Technology Transfer Products

Over three-fourths of the community colleges report offering advanced technology courses, workshops or seminars in relation to technology transfer in the following three areas:

- o Business
- o Computers, computer technology and information sciences
- o Engineering and engineering-related technologies

The majority of colleges also offer advanced technology training and educational courses in the health field. Nearly one-half of the colleges offer advanced training and education in agriculture and about one-fifth offer training and education in the science technologies.

Community colleges are flexible in their delivery of advanced technology training and education. Many of the colleges offer courses and workshops through contract training customized to meet the needs of individual employers and deliver them at employers' locations.

Further, much advanced technical material is incorporated into the colleges' regular occupational and technical curricula via credit courses offered on campus. The colleges are flexible in selecting personnel to deliver technical training and courses, as is evidenced by the use of full-time faculty, part-time faculty or outside consultants.

Topics shown in the chart on the following page are illustrative of the types of technical training and education associated with technology transfer delivered by many of Illinois' community colleges.

Advanced Technology Transfer Training and Education of the Illinois Community College System

Business

Banking and finance
Desktop publishing
Data base management
Entrepreneurship
Human resource development
Real estate
Small business management & marketing
Spreadsheets
Supervision and management
Word processing

Computers, Computer Technology and Information Systems

Computer (mainframe, micro) operations
Computer maintenance, diagnosis and repair
Computer processing
Data processing
Programming languages
Operating systems
Software applications and packages
Systems Analysis

Engineering and Engineering-Related Technologies

Automotive technologies
Architectural technologies
Blueprint reading
Computer aided design and drafting
Computer aided manufacturing
Computer integrated manufacturing
Computer numerical control
Electricity and electronics
Hydraulics
Industrial controls
Machine tool design and technology
Materials science and management
Pneumatics
Programmable controllers
Robotics
Statistical Process Control
Quality control and improvement
Welding technologies

Health

Emergency medical technology
Nuclear medical technology
Nursing and nursing-related technologies
Occupational therapy
Radiologic technology
Rehabilitation services

Agriculture

Chemicals and pesticides
Commodity futures training
Computer farm accounting
Computers on the farm
Financial analysis of farm business
Fundamental and technical analysis of futures markets
Landscape design and management
Microcomputers in agriculture and farming
New technologies in horticulture
Record keeping and market education
Turf management

Science Technology

Microbiology
Industrial physics
Physics for engineering
Hazardous materials
Water availability and plant operations

Key Finding 2: A variety of methods is used to promote technology transfer products of the Illinois community colleges.

At least six promotional methods are used by the Illinois community colleges to initiate technology transfer. Figure 2 reports that all six of the methods identified in the survey are used by approximately two-thirds or more of the community colleges. Of the six, requests and referrals by business and industry is the method reported by the greatest percentage of the colleges, 98%.

Also, quite prevalent as a method of initiating technology transfer is the use of partnerships with local economic development organizations. According to four of five colleges responding to the survey, direct solicitation and publicity/promotion are other important means of initiating technology transfer.

Requests and referrals by internal personnel or students, or by union/labor organizations are used by fewer colleges, however these two methods remain important for approximately two-thirds of the colleges.

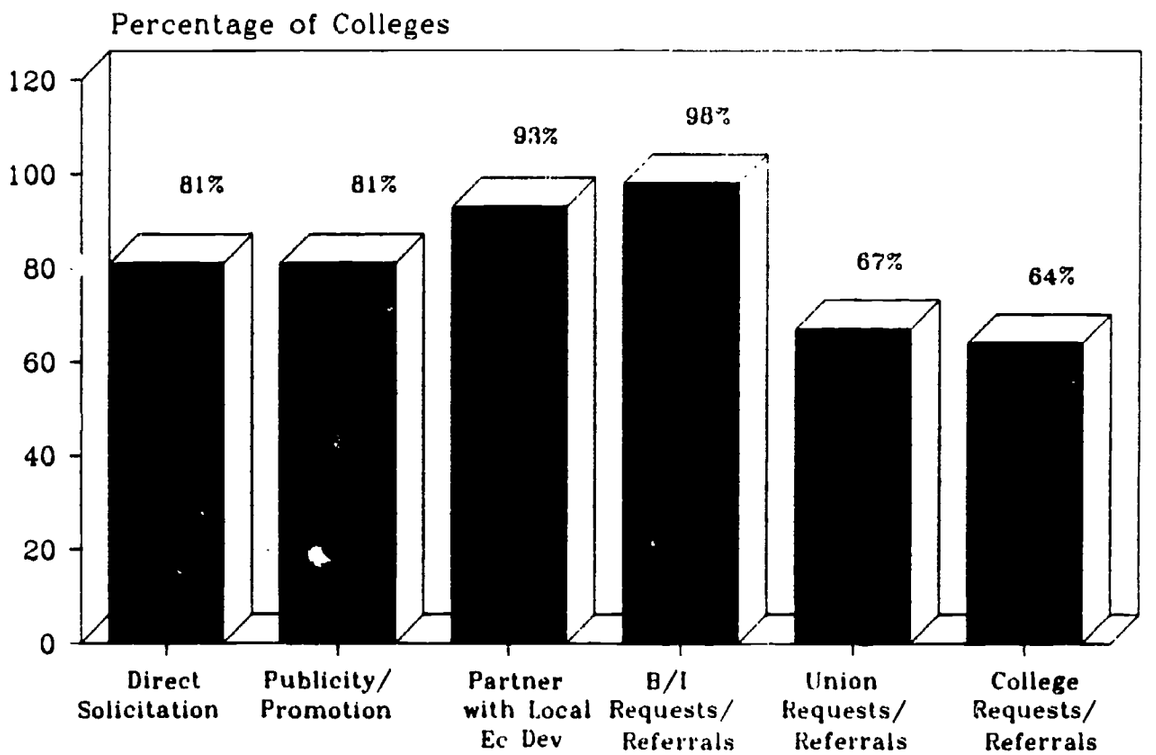

Figure 2. Methods Colleges Use to Initiate Technology Transfer

Key Finding 3: Illinois community colleges serve a wide range of private and public clients.

The diversity of technology transfer products and services is indicative of the wide range of clients of community colleges during FY88 and FY89. Table 2 shows the types of firms that received technology transfer products and services from the community colleges during FY88 and FY89. The majority of community colleges responding to the survey provided technology transfer to the following types of clients:

- o Manufacturing firms
- o Nonmanufacturing firms
- o Individuals and entrepreneurs

At least two-thirds of the community colleges provided technology transfer products and services to manufacturers in the following areas:

- o Electrical/electronic equipment
- o Fabricated metals
- o Machinery

Nearly one-half of the colleges provide products and services to manufacturers in food and kindred products, and printing and publishing companies.

About four-fifths of the colleges offer technology transfer to private nonmanufacturing firms involved in the following types of businesses:

- o Business services
- o Finance, insurance or real estate
- o Retail trade

Over one-half of the colleges also indicated that federal, state and local government offices are nonmanufacturing clients.

Also evident in Table 2 is the importance of providing technology transfer products and services to individuals. About two-thirds of the colleges report the inventor/individual as a client of their technology transfer programs.

Table 2

Types of Clients Receiving Technology Transfer Products and Services During FY88 and FY89

Types of Clients	Colleges Serving Clients n=42 Number	Percent
Manufacturing Clients:		
Electrical/electronic equipment	33	79%
Fabricated metals	30	71
Machinery	29	69
Food and kindred products	20	48
Printing and publishing	20	48
Rubber and miscellaneous plastic products	17	41
Transportation equipment	17	41
Stone, clay, glass	6	14
Nonmanufacturing Clients:		
Business services	34	81
Finance, insurance, real estate	33	79
Retail trade	31	74
Federal, state or local government offices	24	57
Construction	18	43
Public utilities	17	41
Transportation	16	38
Wholesale trade	16	38
Health care, hospitals, pharmaceuticals	7	17
Mining	4	10
Other Clients:		
Inventor, individual	28	67
Agricultural services, forestry, fishery	18	43
Educational institutions	2	5
Union, trade or professional associations	2	5

Key Finding 4: Illinois community colleges form partnerships to facilitate technology transfer.

Over two-thirds of the Illinois community colleges form partnerships with private firms, government agencies/programs, private consultants, professional organizations, and four-year colleges and universities for some technology transfer initiatives (Table 3). Over one-half of the community colleges join with Private Industry Councils and other community colleges to deliver technology transfer.

While the findings clearly point to the importance of partnerships, most of the colleges acknowledge that other organizations in their communities are involved in economic development. Over three-fourths of the community colleges report competition from some of the same types of organizations they involve as partners, (e.g., private firms, private consultants and four-year colleges and universities). Proprietary schools are much more likely to be reported by the colleges as competitors (64%) than partners (5%).

Table 3

Community College Partners and Competitors in Technology Transfer

Types of Partners/Competitors	Colleges Reporting Partnerships n=42		Colleges Reporting Competition n=42	
	No.	Percent	No.	Percent
Private firms (vendors)	32	77%	39	93%
Government agencies/programs, (e.g., U.S. Department of Labor, DCCA)	32	77	12	29
Private consultants	30	71	39	93
Professional organizations and societies	30	71	24	57
Four-year colleges and universities	28	67	36	86
Private Industry Councils	25	60	15	36
Other community colleges	24	57	21	50
Area vocational centers	18	43	12	29
Labor unions, labor management councils	18	43	12	29
Federal laboratories	6	14	2	5
Proprietary schools	2	5	27	64

Key Finding 5: CEOs promote technology transfer.

Roles that are important for CEOs to take usually involve promotion of technology transfer with business and industry leaders, members of the General Assembly and state policy makers. CEOs also take primary responsibility for educating local community leaders and board of trustees about technology transfer. In addition, CEOs must commit college resources to accomplish technology transfer goals. Other roles that are considered important but given slightly lower priority include participation in technology transfer workshops, participation on internal college task forces to plan technology transfer initiatives, and national-level promotion of technology transfer.

Table 4

Preferred Level of Involvement of Community College Presidents In Technology Transfer

Statements about involvement by CEOs	Avg.	None/ Somewhat	A Fair Amount	A Great Deal	Don't Know
Visibility in community partnerships bringing college and business-industry leaders together	3.7	5%	24%	69%	2%
Commitment of college resources to accomplish technology transfer goals	3.6	5	33	57	5
Participation in community service leading to indirect marketing opportunities	3.5	17	19	64	0
Education of trustees about technology transfer	3.4	19	19	57	5
Promotion of state-level, system-wide resources with the Illinois General Assembly, ICCB or others	3.3	21	24	52	2
Participation in foundation board associations leading to requests for service	3.3	12	48	40	0
Development of policy to promote technology transfer with trustees	3.1	26	36	38	0
Participation on college's own task forces to plan and develop internal/external resources, markets, etc.	2.7	39	40	19	2
Promotion of technology transfer on the national level	2.7	42	33	17	7
Participation in workshops/seminars on technology transfer	2.6	52	38	10	0

NOTE: The average represents the mean response of the 42 colleges to the statements about involvement by the CEOs in technology transfer. The responses are weighted as follows: *None*, 1; *Somewhat*, 2; *A Fair Amount*, 3; and *A Great Deal*, 4. The table shows the percentage of the 42 colleges that selected the particular level of response for each statement. The rows may not add to 100% due to rounding.

Key Finding 6: Business and industry seek additional technology transfer products from the Illinois community colleges.

The survey requested that community colleges provide a list of the needs of local business and industry that could potentially be resolved through assistance from community college technology transfer initiatives. A total of 31 colleges provided examples of needs of clients. Listed below are technology transfer products identified frequently by the colleges.

Future Technology Transfer Products

Basic Skills Enhancement	Reading Writing Math Computer literacy Technical communications Report writing
Quality Management and Productivity Improvements	Implementing quality/productivity improvements Team problem solving Participative management Strategic business planning Productivity assessment and enhancement Organizational and cultural change
Advanced Quality Control and Assurance	Statistical Process Control Just-in-time inventory management
Computers	Mainframe and midrange computers Microcomputers Software applications and packages
Advanced Manufacturing Technologies	Computer integrated manufacturing Computer numerical control Robotics Mechanical design Electrical troubleshooting and maintenance Automated manufacturing and drafting
Human Resource Development	Personnel management Supervisory skill development Employee performance evaluation

Several community colleges discussed the importance of small and medium sized firms as key clients of technology transfer programs. Colleges state that these clients often lack the capital to stay abreast of technological developments and, therefore, have difficulty making decisions to acquire technologies to update operations. Some of the community colleges point to the need for state and federal assistance to help underwrite the cost of technology transfer since the needs of many of these firms are not adequately addressed through existing economic development approaches.

Small and medium sized firms, as well as larger companies, increasingly look to community colleges for the following types of technology transfer assistance:

- o Needs assessments
- o Instructional design assistance
- o Productivity assessments
- o Awareness training on technology applications
- o Demonstrations of technology
- o New technology identification and selection assistance

Further, increasingly business and industry is hampered by a workforce lacking in both technical and basic skills. The colleges describe the necessity of providing workforce readiness programs for business and industry employees to ensure their success with technological advancements.

Future Technology Transfer Initiatives

Fifteen of the colleges describe plans to conduct major technology transfer activities involving significant investments in existing or new programs, staff or facilities. Five technology transfer programs of the Illinois community colleges are listed below to provide examples of the types of technology transfer initiatives planned elsewhere in the system.

- o New training programs are planned for the health care profession on nuclear medicine and radiology, for the food service industry on the latest equipment, and for the manufacturing industry on cad-cam and robotics. The programs will involve existing technological facilities, equipment, faculty, and curricula to provide a baseline. New courseware is planned to deliver training at business and industry sites.

- o A state-of-the-art computer lab is being developed to enhance workplace computer skills for a variety of business and industry office and plant employees.

- o An electronics program is being designed to include networking installation, repair and maintenance for local manufacturing industries. As part of the program, new computer numerical control equipment will be installed. It is anticipated that other economic development agencies will be involved in the initiative.

- o A comprehensive range of technology transfer services is being developed including assessments, technical assistance, database access, customized training, funding acquisition assistance, business modernization consulting, and strategic planning.

- o A new degree program and customized training workshops are being developed on computer integrated manufacturing through a partnership with the IBM corporation.

Key Finding 7: Illinois community colleges encounter some roadblocks in delivering technology transfer.

The survey provides useful information to assist community colleges in improving the quality of technology transfer products and services (Table 5). Generally, the colleges see only a few roadblocks to their providing technology transfer assistance. The vast majority of colleges view themselves as meeting local business and industry needs with competitive products and services. Further, they are positive about the time and support provided to technology transfer by community college leaders.

Table 5

Extent of Agreement by Colleges with Statements about Roadblocks to Conducting Technology Transfer

Statements about Roadblocks	Avg.	Strongly Disagree	Disagree	Undecided or No Opinion	Agree	Strongly Agree
Lack of awareness by business/industry of colleges' capabilities for technology transfer	4.0	0%	10%	2%	71%	17%
Lack of funding from federal, state and/or local agencies	3.7	0	14	14	57	14
Lack of equipment or facilities	3.6	0	24	12	43	19
Difficulty of arranging personnel assignments	3.3	0	33	14	36	14
Outdated policies and procedures of the community college system	3.2	5	31	19	29	14
Lack of ability of faculty to provide technology transfer due to limited expertise	3.2	0	41	7	41	10
Lack of recognition of technology transfer as a legitimate function of the college	3.1	2	39	15	32	12
Lack of business/industry in the geographical area with technology transfer needs	2.7	14	38	19	19	10
Lack of a central office or point of contact in the colleges for technology transfer	2.5	14	46	12	24	2
Lack of ability by the college to respond quickly to meet business/industry needs	2.4	17	51	10	17	2
Lack of administrative/leadership time and support	2.2	15	54	17	10	2
Lack of ability of the college to provide technology transfer competitively	2.1	19	57	14	10	0

NOTE: The average represents the mean of the 42 colleges' responses to the statements about roadblocks to conducting technology transfer. The responses are weighted as follows: *Strongly Disagree*, 1; *Disagree*, 2; *Undecided or No Opinion*, 3; *Agree*, 4; *Strongly Agree*, 5. The percentages show the percent of the colleges that selected the particular level of response. The rows may not add to 100% due to rounding.

The colleges are mixed in their reactions toward statements about difficulties with arranging personnel for technology transfer, outdated policies and procedures, lack of expert faculty, and lack of recognition of technology transfer as a legitimate function of the colleges. Apparently colleges across the state have different experiences with these particular aspects of technology transfer.

Finally, the colleges indicated that three of the statements represent potential problem areas regarding technology transfer. A majority of the colleges agreed or strongly agreed with the following statements about roadblocks:

- o The lack of awareness of business and industry about the colleges' technology transfer capabilities
- o The lack of funding from federal, state and/or local agencies
- o The lack of equipment or facilities

Fifteen of the colleges added comments that are helpful in understanding how these particular areas are problematic for them. Their comments are summarized below:

- o **Lack of funding for technology transfer** -- Several colleges point to a lack of funding as a roadblock to providing technology transfer. Indicative of the statements made by the colleges is this comment, *"Financial limitations make it an on-going struggle for the community college to keep up with current technology. Equipment purchases and staff development and training are the first areas to be cut when budgets are tight."*

- o **Inadequate equipment and facilities** -- Some problems in this area include cuts in equipment allocations, the inability of colleges to replace expensive equipment (particularly in computer technology and electronics), and excessive time required to get approval for equipment purchases.

- o **Difficulties in involving college personnel in technology transfer** -- Concerns include internal competition amongst full-time faculty and part-time trainers, difficulties with conflicting teaching schedules, constraints placed on the colleges by unions, the lack of staff development for faculty, difficulties in providing sufficient time for faculty to research and study advanced technologies, difficulties with faculty undercutting college programs, difficulties with hiring qualified faculty for technology transfer, the lack of qualified college personnel to market and coordinate technology transfer, and the vulnerability colleges face with business and industry piroting expert faculty.

- o **Inappropriate policies and procedures to support technology transfer** -- Some of the colleges point to internal policies and procedures, as well as state- and system-level processes, that inhibit immediate and efficient response to business and industry. Specifically, the colleges identify problems with processes involving the allocation of classroom and laboratory space; course registration; methods of determining tuition and credit; marketing; training; and support services for technology transfer.

Key Finding 8: Economic development units along with many other departments of the colleges transfer technology.

The economic development unit, (e.g., small business development center, business and industry training center) is the primary unit in the college that has responsibility for technology transfer. Of the 39 colleges responding to the question, 69% indicate the economic development units have primary responsibility (Figure 3); 82% indicate that these units have either primary or secondary responsibility. Additional data collected through the survey but not shown in the table indicate that occupational and technical education has either primary or secondary responsibility for technology transfer in 44% of the colleges; 15% indicate occupational and technical education has primary responsibility. Two other units that colleges listed as having primary or secondary responsibility for technology transfer are adult/continuing education and academic departments.

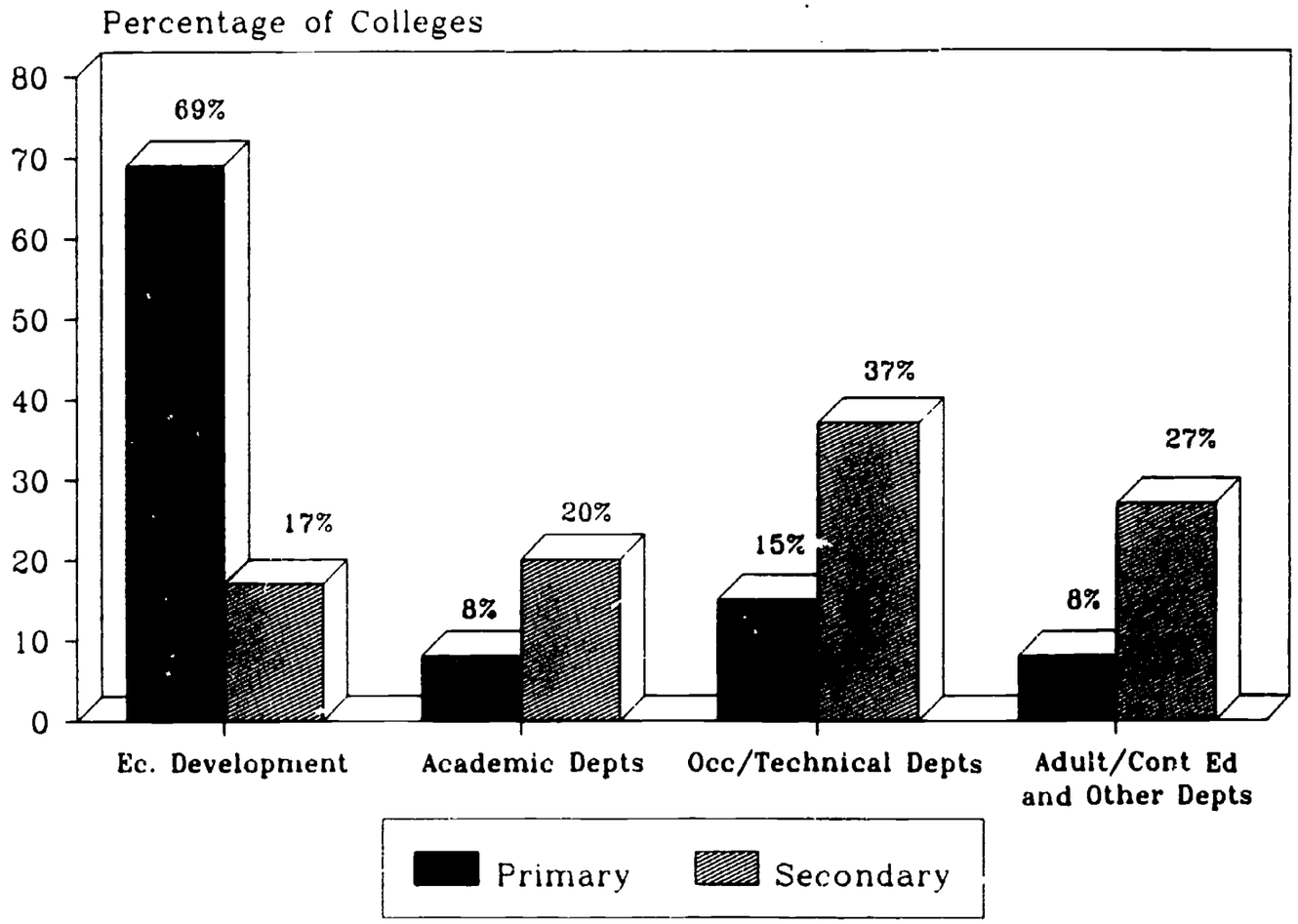

Figure 3. College Units with Primary and Secondary Responsibility for Technology Transfer

The vast majority of colleges (74%) report that economic development units are the first point of contact for clients seeking technology transfer (Figure 4). About one-fifth of the colleges report that occupational and technical education departments are the first point of contact for clients and even fewer describe other college units as recipients of initial requests for technology transfer products and services.

Figure 4 also reveals that whereas economic development units are usually the point of initial contact for technology transfer, other college departments play a vital role in providing the products and services. Over 70% of the colleges report that occupational and technical departments, CEOs' offices, and adult/continuing education are involved in technology transfer. Almost one-third of the colleges also involve student learning centers in the activities.

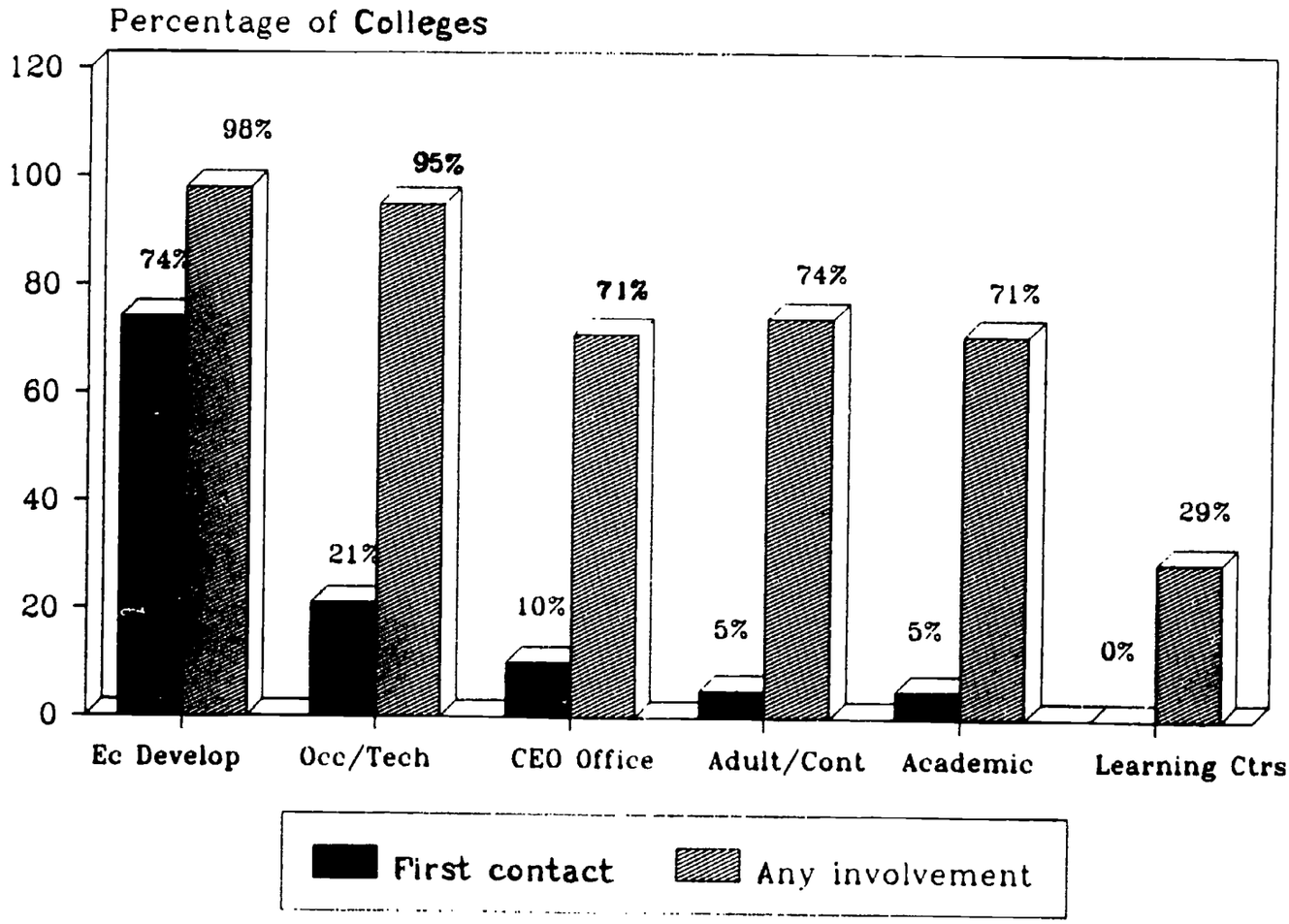

Figure 4. Level of Involvement of College Units in Technology Transfer

Key Finding 9: Internal evaluation methods are used routinely to assess technology transfer.

At least 50% of the colleges regularly evaluate all of the outcomes presented in the survey in some manner (Table 6). Over four-fifths of the colleges report conducting regular evaluations related to the following three outcomes:

- o Profit/revenue and cost
- o Efficiency and/or effectiveness
- o Number of programs offered

Outcomes evaluated by fewer colleges include benefits to the colleges' own personnel, facilities and equipment. Only about one-half of the colleges indicate they typically evaluate such outcomes. Of course, any programs involving occupational and technical curricula undergo program evaluation on a regularly scheduled basis. These evaluations examine questions of program effectiveness and benefits to graduates and employers formal follow-up data collection procedures.

Internal college personnel typically conduct evaluations of technology transfer using informal communications and, less often, surveys and formal interviews. Only in the area of efficiency and/or effectiveness did a substantial percentage of the colleges (50%) indicate involvement by an individual or organization outside of the college, (e.g., their business and industry client). Less than one-third of the colleges use formal and extensive evaluation studies and only a very small number of the colleges use consultants on a regular basis to evaluate technology transfer.

Table 6

Evaluation Processes Reported by Community Colleges for Technology Transfer

Types of Outcomes of Technology Transfer	Percent of Colleges Evaluating	Type of Evaluator			Evaluation Methods		
		College	B/I	Consultant	Informal Comm.	Survey/ Interview	Formal Studies
Profit/revenue and costs	88%	86%	5%	7%	38%	43%	31%
Efficiency and effectiveness	86	83	50	10	67	62	17
No. of technology transfer programs	81	79	17	0	48	36	29
Benefits to business/industry and economy	79	76	38	14	45	55	29
Benefits to students and graduates	69	64	31	0	45	50	17
Benefits to college personnel	57	52	2	2	55	10	5
Benefits to college facilities, equipment	55	50	12	7	50	14	12

NOTE: The table shows percentages of the 42 colleges that indicated conducting the various categories of evaluation activities. The respondents could check any or all of the categories, therefore the rows may not add to 100%.

Key Finding 10: Full-time faculty experts play an important role in transferring technology.

Most prevalent amongst the range of possible arrangements that colleges make involve full-time faculty in technology transfer is the salary supplement or stipend (Figure 5). Over four-fifths of the colleges provide faculty with salary supplements or stipends for their participation in technology transfer. Only approximately one-third of the colleges make such arrangements as decreasing teaching loads or compensating faculty with equipment or facilities as means of rewarding faculty involvement in technology transfer. Only about one-fifth of the colleges create new types of faculty positions for technology transfer. Further, 12% of the colleges make no special arrangements for technology transfer.

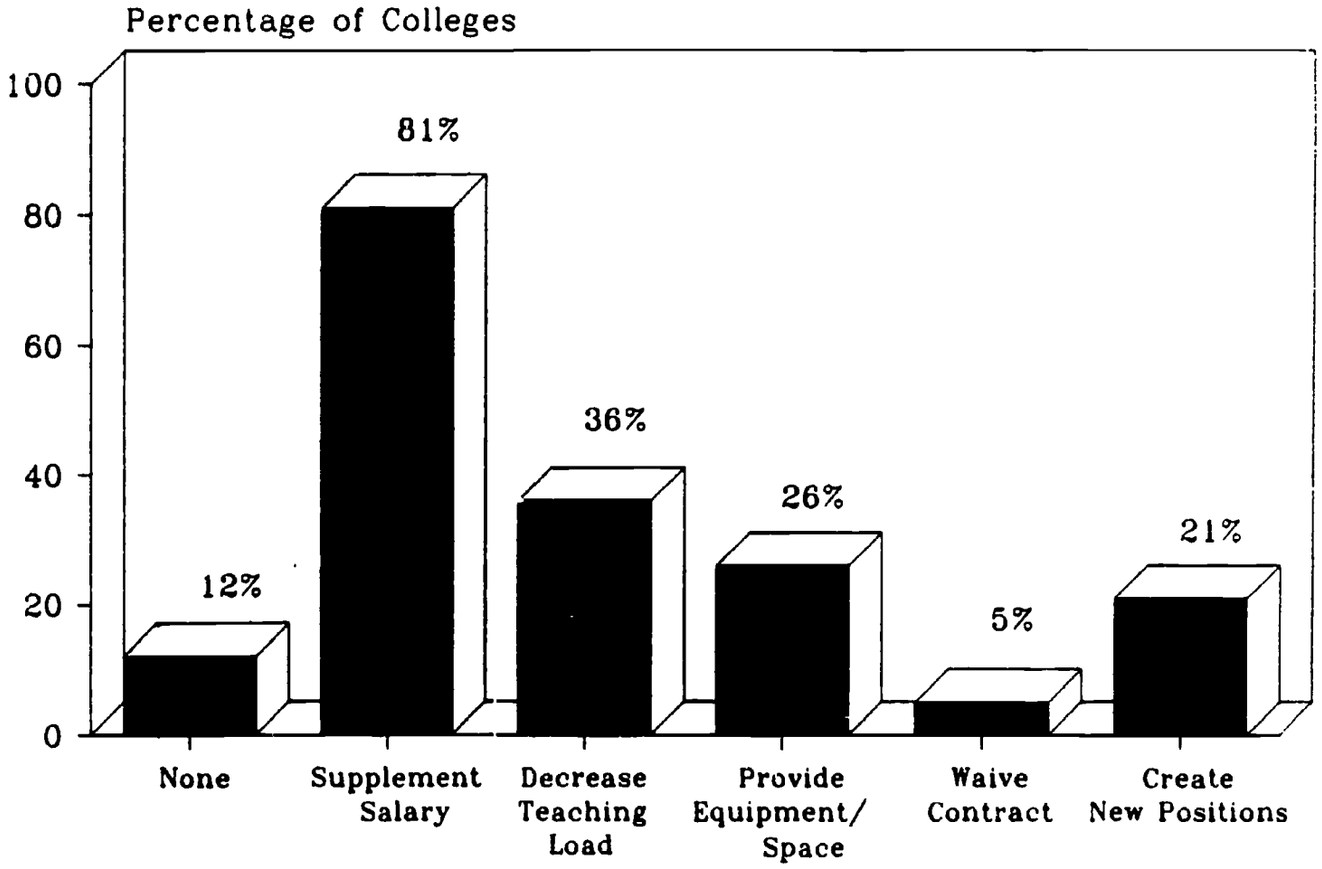

Figure 5. Arrangements to Involve College Faculty in Technology Transfer

Colleges use a wide range of professional development approaches to enhance the ability of faculty to contribute to technology transfer (Table 7). Most prevalent among the professional development activities are internal conferences, workshops and Quality Assistance Program (QAP) funds. Over four-fifths of the colleges offer professional development of this type to faculty. Nearly as many colleges use Vocational Instructional Program (VIP) funds to develop faculty for technology transfer. The majority of the colleges also use such programs as vendor training, tuition reimbursements and sabbatical leaves.

Less than one-third of the colleges offer faculty and staff exchanges with other colleges or universities or job sharing with businesses and industries as a means of developing faculty for technology transfer. In the future, these types of approaches may need to be explored to provide intensive professional development opportunities for faculty.

Table 7

Professional Development Offered For Faculty To Enhance Technology Transfer

Types of Professional Development	Colleges Offering Professional Development n=42	
	Number	Percent
Internal professional development conferences, workshops	35	83%
Quality Assistance Program (QAP) funds	35	83
Vocational Instructional Program (VIP) funds	33	79
Business and industry personnel employed as part-time faculty	28	67
Training and education through business and industry vendors	26	62
Tuition reimbursements and waivers for coursework	25	60
Sabbatical leaves to enhance knowledge and skills	22	52
Arranged leave to work in business and industry	22	52
Faculty/staff exchanges with others	12	29
Job trading/sharing with business and industry personnel	3	7

Key Finding 11: Pricing policies for training associated with technology transfer reflect local fee structures.

The survey requested that colleges provide price quotes for four different types of customized training typically associated with technology transfer. In all four cases, the total prices colleges described for the training varied greatly, as is evidenced by the standard deviations shown in Table 8.

Table 8

Pricing of Training Associated with Technology Transfer

Description of Training	No. of Colleges Responding	Avg. Total Price	Standard Deviation
Introductory-level spreadsheet software training offered in 8 hours of instruction on campus for 10 employees of a local company. (Six hours of development time are included in the estimate.)	38	$ 997	491.9
Basic supervisory training offered over 8 weeks, totaling 40 hours of instruction, for 10 employees on site at a local company. (Ten hours of development time are included in the estimate.)	38	2,649	1338.5
Technical training for 30 fabricators and assemblers of a local company offered on site over a 3-week period, totaling 60 hours of instruction. (Thirty hours of development time are included in the estimate.)	34	7,598	4009.7
A regular English as a second language course for 10 employees of a local company	31	1,742	1342.6

Generally, community colleges figure a number of different items into their calculations when determining a total charge for training. Many of the colleges price training using the some of the following types of fees:

- o Instructor
- o Administrator

- o Student
- o Books and supplies
- o Facilities/equipment usage
- o Marketing
- o Surcharges and overhead
- o Development

Much of the variation in total charges is attributable to the variation in charges for instruction, development and administration, (i.e., indirect or overhead). Fees for instructors vary from $20.00 to $100.00 per hour; development fees vary from $0 to $50.00 per hour; administrative charges range from 0% to 60% of total direct costs. Other variables that seemed to be important but more difficult to quantify include the location of the college and level of competition amongst training providers in the local marketplace.

Key Finding 12: Formal agreements and contracts are comprehensive and inclusive in scope.

The colleges typically use formal agreements or contractual arrangements when providing technology transfer (Table 9). Generally the agreements spell out the ways resources such as time, money, personnel, equipment, and facilities are to be used to accomplish technology transfer. Of the items listed in the survey for colleges, the item identifying length of involvement in partnerships was selected most often and the item specifying personnel details was selected least often by the colleges.

Table 9

Items Contained in Formal Agreements for Technology Transfer

	Colleges Reporting Items (n=42)	
Items in Formal Agreements	Number	Percent
Length of involvement in partnership	41	98%
Pricing and funding strategies	40	95
Equipment, laboratories or facilities	39	93
Credit hours, experiential learning credits, certificates, or degrees	38	91
Description of objectives	35	83
Description of tasks to be accomplished	34	81
Memorandum denoting partner responsibilities	31	74
Details concerning personnel	25	60

The Technology Transfer Survey Recommendations

The survey findings have implications for plans the Illinois community college system will make regarding future technology transfer initiatives. In this regard, five recommendations are formulated to provide a framework for public policy development, technology transfer program development, and further study of technology transfer and the Illinois community college system. These recommendations result from a thorough analysis of the data obtained from this survey and recognition of the important role Illinois community colleges play in economic development. The five recommendations are:

1. **Ensure that internal college and system-wide administrative policies and processes support efficient and effective delivery of technology transfer.** Processes such as curriculum development, course registration, facilities allocation, and marketing need to be designed to support technology transfer. More study is needed to determine the range of prices that is reasonable for community colleges to charge for training associated with technology transfer. The colleges should also explore establishing pricing guidelines, taking into account such factors as geographic location, college characteristics and client needs.

2. **Continue to strengthen partnerships with other organizations that provide technology transfer assistance.** A strength of the Illinois community college system's involvement in technology transfer is its contributions as a broker of technology transfer services. Community colleges are actively involved in networking with organizations and experts within communities to provide technology transfer programs. In many cases, partnerships provide cost-effective means of providing technology transfer to the commercial marketplace. As technology transfer evolves, community colleges are likely to become increasingly knowledgeable about the types of products and services they can provide via partnerships. It is very important for the accomplishments of community colleges in this area to be promoted to assist employers throughout the state. A state-wide network is needed amongst the community colleges to enable them to play a more pivotal role in coordinating technology transfer initiatives in their communities and across Illinois.

3. **Ensure that technology transfer initiatives of the Illinois community college system are adequately funded.** Adequate levels of funding are needed from within the colleges as well as from external sources, primarily public sources. In order for colleges to maintain the necessary facilities, equipment, faculty, administration, and support services to offer technology transfer, it is important to have well-funded programs. Community colleges are in an excellent position to meet the needs of small and medium sized firms that have the greatest demand for infusing costly advanced technologies into their operations. In this regard, the state's dependency on community colleges as providers of economic development must include provisions for financial resources.

4. **Continue to develop the expertise of college faculty and explore incentives to involve full-time faculty experts in technology transfer.** As technology becomes increasingly complex and community colleges play a bigger role in technical assistance, it will be important for colleges to provide intensive professional development opportunities to enhance the technical expertise of faculty. Innovative incentives are needed to involve faculty in key roles in delivering technology transfer.

5. **Explore opportunities to evaluate and improve technology transfer programs through on-going formal evaluation processes.** The questions of quality, effectiveness and efficiency in regard to programs linked to technology transfer are quite complex. It is important for the colleges to have a clear understanding about the scope and benefits of technology transfer programs to be able to make meaningful decisions and plans. In order to create useful measures for tracking the involvement of community colleges in technology transfer within the state of Illinois, on-going data collection processes need to be developed. Further, formal program evaluation approaches are needed to determine the impact of community college technology transfer programs on the local and state economy.

Members of the Advanced Technology and Economic Development Committee for 1989-90

Harry J. Braun, President, Danville Area Community College

Charles P. Ferro, President, Morton College

Paul R. Heath, President, Elgin Community College

Karl J. Jacobs, President, Rock Valley College

Daniel J. LaVista, President, College of Lake County (Chair)

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Herbert C. Lyon, Chancellor, Black Hawk College

Raymond A. Pietak, President, Joliet Junior College

Thomas K. Thomas, President, Illinois Central College

Theodore Tilton, Provost, College of Du Page

Illinois Community Colleges Participating in the Survey

*Belleville Area College, Belleville
*Black Hawk College, Quad Cities campus, Moline and East campus, Kewanee
City Colleges of Chicago:
  *City-Wide College, Chicago
  Richard J. Daley College, Chicago
  Malcolm X College, Chicago
  Olive-Harvey College, Chicago
  Harry S. Truman College, Chicago
  Wilbur Wright College, Chicago
*Danville Area Community College, Danville
*College of DuPage, Glen Ellyn
*Elgin Community College, Elgin
William Rainey Harper College, Palatine
Highland Community College, Freeport
Illinois Central College, East Peoria
Illinois Eastern Community Colleges:
  Frontier Community College, Fairfield
  Lincoln Trail College, Robinson
  Olney Central College, Olney
  Wabash Valley College, Mt. Carmel
Illinois Valley Community College, Oglesby
Joliet Junior College, Joliet
Kankakee Community College, Kankakee
Kaskaskia College, Centralia
Kishwaukee College, Malta
College of Lake County, Grayslake
Lake Land College, Mattoon
Lewis & Clark Community College, Godfrey
Lincoln Land Community College, Springfield
John A. Logan College, Carterville
McHenry County College, Crystal Lake
Moraine Valley Community College, Palos Hills
Morton College, Cicero
Oakton Community College, Des Plaines
Parkland College, Champaign
Prairie State College, Chicago Heights
Rend Lake College, Ina
Richland Community College, Decatur
Rock Valley College, Rockford
Carl Sandburg College, Galesburg
Sauk Valley Community College, Dixon
Shawnee Community College, Ullin
Spoon River College, Canton
South Suburban College, South Holland
Triton College, River Grove
*Waubonsee Community College, Sugar Grove
*John Wood Community College, Quincy

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*Denotes colleges that participated in the field test of the survey.