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AUTHOR Owen, H. James
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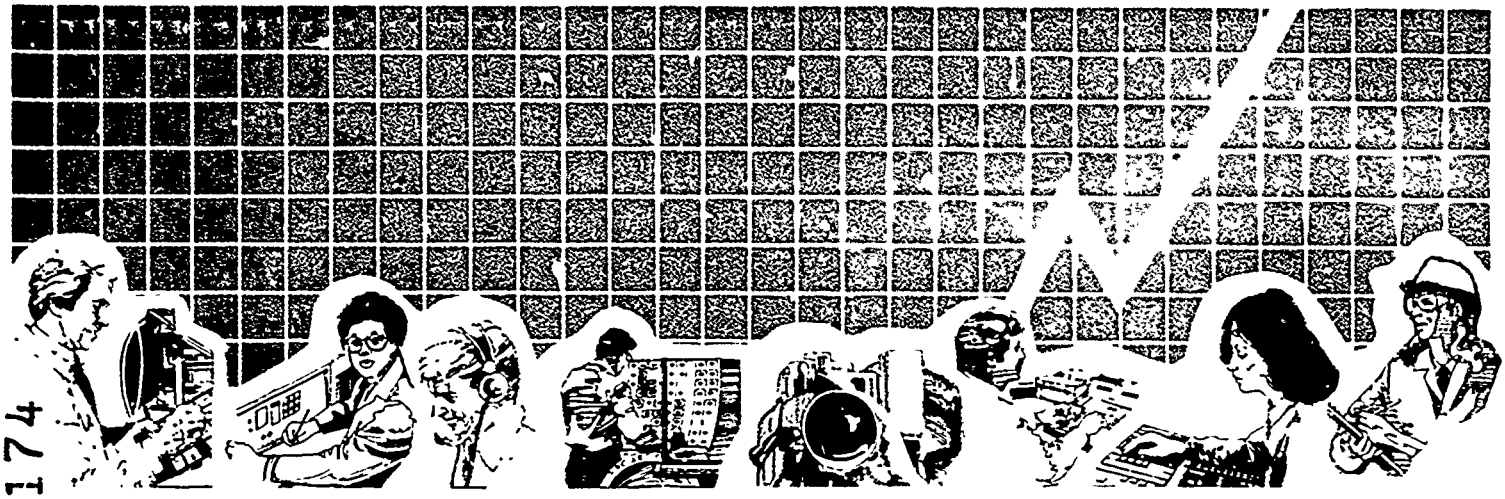
ABSTRACT

In an effort to document how existing industry sees the current status of trained technicians, the American Association for Community and Junior Colleges' Council for Occupational Education, the Association of Community College Trustees, and the Electronic Industries Association conducted a targeted national survey of technician supply and demand. Staff at 23 community and technical colleges surveyed business and industry in 20 metropolitan areas within 15 states. Of the 353 industries participating in the survey, 293 gave complete responses. Study findings included the following: (1) 54% of the responding firms had affiliated subsidiaries, 36% were wholly owned companies, and 10% did not classify themselves as either; (2) 36% were engaged in manufacturing, 10% in research and development, and 14% in both manufacturing and research and development; (3) the top ranked basic skills or competencies required of entry-level technicians were basic electronics, mathematical competence, communication skills, blueprint reading, and knowledge of test equipment; (4) the top ranked steps for alleviating present technician shortages were "increase in-house training," "increase recruitment efforts," and "utilize existing training from community and technical colleges"; (5) company expansion and industry-wide growth and demand for technicians were the leading perceived causes of technician shortages; and (6) 37% of the industries indicated that the associate degree was the minimum educational requirement for entry-level technicians. The survey instrument is appended. (RO)



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Volume I

Monograph Series

Number 1

COUNCIL FOR OCCUPATIONAL EDUCATION

2

AN AFFILIATE OF THE AMERICAN ASSOCIATION OF COMMUNITY & JUNIOR COLLEGES

Technician Supply and Demand: How Can Community and Technical Colleges Help Fill the Need?

February, 1984

Prepared by:

Dr. H. James Owen, President
Tri-Cities State Technical Institute
Blountville, Tennessee 37617

formerly:

Vice President for Program Services
North Carolina Department of Community Colleges
Raleigh, North Carolina 27611

with assistance from:

American Association of Community and Junior Colleges (AACJC)
Council for Occupational Education (COE)
Council for Community Services and Continuing Education (NCCSCE)
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Northern Virginia Community College, Annandale, Virginia
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Seattle Community College District, Seattle, Washington
Tarrant County Junior College, Fort Worth, Texas
Wake Technical College, Raleigh, North Carolina
Washtenaw Community College, Ann Arbor, Michigan
Westchester Community College, Valhalla, New York

Overview

National data indicate that a widening gap in technician availability will occur during the remainder of the 1980's. The West and Southeast will have the greatest needs. In an effort to document how existing industry sees the current status of trained technicians, the AACJC Council for Occupational Educational (COE), the Association of Community College Trustees (ACCT) and the Electronic Industries Association (EIA) conducted a targeted national survey during 1983.

While the data may not be entirely firm, the American Society for Training and Development (ASTD) study by Carnevale and Goldstein was also reviewed. It indicates that non-school providers including the military currently provide the majority of the job-related education and training. Community and technical colleges are identified as a major untapped resource in training for the military services as well as for business and industry. In summary, the point is made that community and technical colleges should not leap, but move carefully and cautiously into the development of "high tech" programs.

The Technician Shortage

In its May, 1981 report, the American Electronics Association (AEA) projected needs across the board for technicians trained in the broad field of electronics. This report entitled "Technical Employment Projections of Professionals and Paraprofessionals: 1981-1983-1985" was cited in the AACJC concept paper entitled "Putting America Back to Work". In attempting to draw attention to programs to target for inclusion in any new national employment and training legislation, "Putting America Back to Work" noted several skill shortage areas outlined in the 1981 AEA projections.

In an effort to update its 1981 projections, the American Electronics Association surveyed 815 companies representing one-third of the electronics industry during 1983. This survey led to a report entitled "Technical Employment Projections, 1983-87." The results indicated that the electronics industry will need over 60 percent more technicians by 1987 than are employed in 1983. The industry indicates that more than 115,000 new technician jobs will open up by 1987 in addition to any needed replacements for workers lost due to attrition. It is important to note that these technicians need skills which are now provided by existing community and technical college programs. While the largest numerical growth will be in both the electronic assembly and electronic technician areas respectively, the largest percentage growth, though the smallest number, will be in the broad area of drafting.

While the "bread and butter" areas show the greatest numerical growth, significant growth is also shown in the high technology areas of robotics, computer assisted design (CAD), computer assisted manufacturing (CAM), and fiber optics. The exact number of new jobs is difficult to assess based upon the relatively small number of industrial respondents. While the percentage increases in these fields will range from 100 to 700 percent over the present employment force, the absolute number of new positions will be relatively small as a portion of total jobs. The report also cautioned that the area of high technology cannot be looked upon as providing the total answer to the country's employment needs. The report indicates that the high technology area should be looked upon as having a significant impact through the job multiplier effect in service and other areas through improved productivity. The rank order of geographic growth areas nationally is as follows: (1) West, (2) Southeast, (3) Northwest, (4) New England, (5) Southwest, (6) Midwest, (7) Mid Atlantic.

The results also point out that companies with 50 or fewer employees predict the larger percentage increase in additional future technician jobs as compared with companies employing 500 to 1,000 persons. Additional growth is also anticipated nationally in the professional areas of baccalaureate degree and higher engineers in the area of software engineering, computer analysts, and electronics engineering. The AEA report further goes on to state that approximately 16 percent of the technician increases are based upon anticipated defense contracts from the United States Government.

These results, while very significant, do not give the full picture. The military services will also need increased numbers of personnel to operate and maintain the increasingly complex weapons and related systems that are continually coming on line. Evidence of this need was presented by AACJC/ACCT witnesses in the December 1983 hearings in Iowa on the Skilled Enlisted Reserve Training Act (SERTA) H. R. 1937 and S.801 chaired by Senator Roger W. Jepsen, (R.-Iowa).

Technician Shortage Survey Results

In an effort to document the areas of strength of community and technical colleges indicated previously, the AACJC Council for Occupational Education (COE) along with the Association of Community College Trustees (ACCT) and the Electronic Industries Association (EIA) jointly sponsored a National Technician Supply and Demand Survey during 1983. The staff at 23 community and technical colleges surveyed business and industry in 20 metropolitan areas within 15 states. Of the 353 industries participating in the survey, 293 gave complete responses.

Rank Order of Businesses and Industries Responding by State

State	No. of Companies Surveyed	% of Respondents	State	No. of Companies Surveyed	% of Respondents
Florida	45	15.4	Georgia	21	7.2
North Carolina	29	9.9	Texas	19	6.5
Colorado	28	9.6	Arizona	16	5.5
Massachusetts	26	8.9	California	14	4.8
Michigan	26	8.9	New York	13	4.4
New Jersey	22	7.5	Ohio	8	2.7
Illinois	22	7.5	Washington	3	1.0
			Connecticut	1	0.3
			TOTALS	293	100%

A profile of the companies surveyed indicated that 157 or 54 percent had affiliated subsidiaries while 105 or 36 percent were wholly owned companies. Ten percent of the firms surveyed did not classify themselves as either wholly owned or with affiliated subsidiaries. In terms of the type of business, 106 or 36 percent were engaged in manufacturing, 28 or 10 percent were engaged in research and development, 42 or 14 percent were engaged in both research and development and manufacturing, and 111 companies or 38 percent identified themselves as "other". Five companies or two percent did not respond. In the area of technician skill requirements, the companies surveyed identified 15 areas of skills or competencies which they require from an entry level technician. The items high on the list involve basic electronics, mathematical competence, communication skills, blueprint reading and knowledge of test equipment. The nation's community and technical colleges can profit from the rank order of skills and competencies as they compare their existing programs in the broad technician areas to ascertain the degree to which their current programs support these skills.

Rank Order of Basic Skills or Competencies Required from an Entry Level Technician

Skill	Number Mentioning	% of Respondents Mentioning Item
Basic Electronics	98	33.4
Mathematical Competence	71	24.2
Schematics/Blueprints	70	23.9
Test Equipment	56	19.1
Communications Skills	55	18.8
Work Experience	55	18.8
Circuits	43	14.7
Troubleshooting	43	14.7
Digital Electronics	32	10.9
Analog Systems	22	7.5
Wiring/Soldering/Welding	20	6.8
Manual Dexterity	20	6.8
Analytical Ability	18	6.1
Instrumentation	18	6.1
Measuring/Calibration	16	5.5

Business and industry gave community and technical colleges a pat on the back when it came to answering the question on how steps are being taken by business and industry to alleviate present technician shortages. While industry said that in-house training and recruitment efforts should be increased, they gave high marks to utilizing the existing training from the nation's community and technical colleges. Community and technical college training still ranked third, however, indicating that there is still room for improvement.

Rank Order of Steps to Alleviate Present Technician Shortages*

Method	Number Mentioning	% of Respondents Mentioning Item
Increase In-House Training	122	41.6
Increase Recruitment Efforts	87	29.7
Training From Community & Technical Colleges	79	26.9
Improved Benefits and Working Conditions	61	20.8
Increase Use of Part-time Employees	48	16.4
Increase Use of Overtime Work	48	16.4
Increase Wages Of Existing Staff	33	11.3
Increase Training at Private Technical Schools	25	8.5
Other	28	9.6
No Present Shortages	148	50.1

*Percent of respondents exceed 100% as many companies mentioned more than one item.

In keeping with the American Electronics Association Survey, the business and industries surveyed indicated that company expansion and industry-wide growth and demand for technicians were the leading perceived causes for present technician shortages in their company. Quality of outside training was an issue, as was insufficient output from community colleges.

Rank Order of Perceived Causes for Present Technician Shortages

Cause	Number Mentioning	% of Respondents Mentioning Item
Company Expansion	62	21.2
Growth in Demand (industry-wide)	58	19.8
Poor Training Received	36	12.3
Insufficient Comm. Coll. Output	28	9.6
Decline in New Entrants	20	6.8
Geographical Location (of firm)	16	5.5
Other	86	29.4

The basic technician types were reported in the survey to be the most common technician categories hired in the last twelve months. The rank order of the eleven top technician types are listed below. What is probably more significant is what is not on this list: the "high technology" technician areas. The survey indicated that 9 technician categories generally regarded as "high technology" areas represented less than 10 percent each of the technicians hired in the last twelve months. As in the American Electronics Study, these areas are relatively fast growing in percentages but also relatively smaller in number to the total number of all technicians that will be needed in the next five years.

Most Common Technician Types Hired in the Last 12 months

Technician Type	Number Mentioning	% Mentioning Item
Electronics Engineering	143	48.8
Electrical Engineering	98	33.4
Computer Programmer	89	30.4
Electromechanical	79	27.0
Manufacturing Engineering	60	20.5
Chemical Technician	57	19.5
Mechanical Drafting	54	18.4
Instrumentation	48	16.4
CAD/CAM	45	15.4
Industrial Engineering	41	14.0
Mechanical Engineering	40	13.7

"High Technology" Technician Areas Mentioned by less than 10% of Respondents

Biomedical Technician
Energy Management Technician
Environmental Science Technician
Fiber Optics Technician
Genetic Engineering Technician
Industrial Ceramics Technician
Nuclear Technician
Occupational Safety and Health Technician
Robotics Technician

The average number of employees per firm surveyed was about 1,400, while the average number of professional engineers was 117 or about 8 percent of the companies' total workforce. The average number of technicians per firm was 116, or also about 8 percent of the workforce. While over 60 percent of the responding firms indicated that the survey question on "number of technicians to support one engineer" was not applicable, national statistics developed by Vetter and the Scientific Manpower Commission indicate the national average on the number of technicians to support one engineer is on the order of three to five technicians to one engineer.

In the area of minimum educational requirements for entry level technicians, community and technical colleges received their greatest support. Thirty-seven percent of the industries surveyed indicated that the associate degree was the minimum educational requirement for entry level technicians in their firm. While 26 percent of the industries gave more than one category, the 37 percent response for the associate degree is contrasted with 11 percent and 10 percent respectively for the bachelor's degree and the high school diploma. The recognition of the associate degree by business and industry gives much support for AACJC/ACCT legislative initiatives in Congress to utilize community and technical colleges in "putting America back to work" and in helping to meet the technician needs of the military.

Minimum Educational Requirements for Entry-Level Technicians

Level	% Responding
Associate Degree	37.0
Bachelor's Degree	11.0
High School Diploma	9.9
Other	7.0
Industry In-house Training	4.7
Equivalent Military Training	4.2
More than one level given	26.2

Industry provides about one-third of the nation's job-related education and training according to a recent study by Carnevale and Goldstein. The survey respondents, however, do not regard in-house training as a sufficient minimum level for hiring entry level technicians.

Of the industries surveyed, 57 percent estimated the labor supply for technicians generally to be adequate. A relatively high 32 percent of the industries indicated that technicians were in scarce supply, while 11 percent said the supply was plentiful.

This support for the associate degree also comes at a time when an American Association of Community and Junior Colleges National Task Force to Redefine the Associate Degree found that the associate degree is "alive and well". The Task Force surveyed business and industry as well and found that many of the skills and competencies identified in the present Technician Supply and Demand Survey were also given a very high priority. Increased or higher standards and establishment of minimum competencies for all students seeking a degree were also strong recommendations of the Task Force. The Task Force further recommended the establishment of an associate in high technology degree that could be designed with the help of business and industry and such a degree could incorporate both liberal learning and technical education as an integral part.

Who Does The Training Now?

In an effort to show who does the training in our country, Carnevale and Goldstein recently completed a report for the American Society for Training and Development (ASTD) entitled "Employee Training: Its Changing Role and An Analysis of New Data." Amercian business and industry spend nearly $30 billion a year on the education and training of 11 million employees. The bulk of the data in this report came from the U.S. Census Bureau's survey of adult education. Carnevale and Goldstein indicate that of the training taking place outside business and industry, 63.5 percent took place at colleges and schools. This breaks down into 35 percent for four-year colleges, 19 percent for two-year colleges and 7 percent for vocational, trade and business schools.

Carnevale and Goldstein indicate there is no category of course that employers feel unable to provide among the 14 different categories of courses surveyed. Of all of the courses offered by business and industry, nearly 40 percent of the in-house courses were in business and nearly 20 percent were in the area of engineering.

School and Nonschool Providers For Job-Related Education and Training*

Provider of Instruction	Percent
•Schools:	
Elementary and secondary	0.4
Two-year colleges	6.4
Four-year colleges and universities	16.3
Vocational schools	9.5
Proprietary schools	9.0
Correspondence schools (civilian)	2.9
Sub Total	44.6
• Non School Providers:	
Business firms	33.9
Professional associations	2.7
Labor unions	0.1
Armed forces:	
Training (except basic training)	3.0
Correspondence	2.7
Prisons	0.5
Other government programs:	
Manpower training	7.7
Cooperative extension	1.2
Employee training and other	2.0
Community-based programs	1.3
Tutors	0.2
Sub Total	55.3
TOTAL	100.0

*Source: Carnevale and Goldstein, "Employee Training: Its Changing Role and An Analysis of New Data." This chart shows where money for job-related training is spent, eliminating the overlap between training paid for by employers but conducted at other institutions, such as schools. Figures for nonschool providers, therefore, reflect only in-house training.

According to the Carnevale and Goldstein report, nonschool providers, including the military, currently provide a majority of the job-related education and training. While they have tremendous capabilities, community and technical colleges still remain a largely untapped resource in the area of education and training. The school and nonschool provider data above must be questioned, however, since two-year colleges surely provide more than 6.4 percent. This rather low figure for two-year colleges must be based on a narrow definition of "job-related education and training", and, in addition, much of the "manpower" training is done through two-year colleges.

Role of Community and Technical Colleges

In "Putting America Back to Work" the AACJC Task Force members identified a number of areas where community and technical colleges were well positioned to fill these skills needs. They indicated that the nation's over 1,200 community, technical and junior colleges can (1) prepare technicians and skilled workers for specific occupations, including defense-related occupations, and (2) provide literacy training, upward mobility, and retraining opportunities for employees particularly aimed at skilled worker shortages, and (3) participate in statewide economic development and reindustrialization strategies.

The AACJC/ACCT legislative program for 1983, and carried forward into 1984, indicates the capabilities of community and technical colleges to meet the needs of business and industry for trained technicians. In addition, community and technical colleges can augment specific technician needs identified by the military services.

In addition to the above, many community and technical colleges are directly involved with the Job Training Partnership Act (JTPA) programs at the local level, and many dislocated workers will be retrained for new careers. If the Vocational Education Act (VEA) is refocused as proposed by AACJC and AVA, new initiatives for economic development and adult retraining will go far toward meeting industries' needs.

Summary

While the industries responding to this survey were from the broad field of electronics, electronics today serves as the cornerstone of our shift from what Naisbett calls the transition from manufacturing to an information society.

The various local studies and surveys that are ongoing involving business, industry and community and technical colleges will definitely provide results which will be used to further support and undergird the community college mission nationally. These results can only serve to inform Congress, the military, and business and industry of the role that community and technical colleges can play and are playing in the training of technicians to meet the needs of our nation's growing and increasingly productive workforce.

Among conclusions that can be drawn from this study are the following:

- While the percentage increase in the technician categories cited are high, the absolute numbers of new positions is modest in these industries in relation to total jobs projected.
- The findings support the thoughts by Owen that strong general education components are crucial to meeting the needs of today's technology.
- Community and technical colleges can help fill projected technician demands by careful assessment of local industry needs along with strengthening the quality and competencies of the graduate to meet industry needs as set out in the survey responses.
- Community and technical colleges should not leap, but move carefully and cautiously into the development of "high tech" programs.

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Electronics Industries Association

December 21, 1982

Your area has been identified as one of 20 geographical areas in the country to participate in a sample survey of technician supply and demand. Thirty-one community and technical colleges have been invited to participate in this national effort. A list of the geographical areas involved and colleges participating is attached to this letter along with 30 copies of the survey instrument. The effort is being conducted under the joint auspices of EIA, AACJC and ACCT.

It is our request that you survey a minimum of 25 companies in your service area. The companies selected should be a mix of types of industries as well as be from large to medium in size, and should employ the types of technicians listed on page two of the survey instrument.

These survey results will be used to further support and undergird the community college mission nationally. The survey results, while kept in a confidential manner, will be aggregated for the purpose of informing business, industry and the military of the role community colleges can play in technician training. This should enhance an already growing community college-industry linkage nationally with the results being used to carry our message to Congress and the business community at large.

We would be most appreciative if you would return a minimum of 25 completed survey instruments to the address below by February 1, 1983. Please return your individual surveys as a group to the following address:

Dr. H. James Owen, Vice President for Program Services
North Carolina Department of Community Colleges
114 W. Edenton Street, Raleigh, NC 27611

Thank you very much for your assistance in this most important national survey. If you have any further questions, please do not hesitate to contact Dr. Owen at the phone number below.

Sincerely,

H. James Owen
Member, Board of Directors
AACJC Councils for Occupational
Education and Community Services
and Continuing Education
(919) 733-3345

Thomas B. Patton, Director
Human Resources Council
Electronic Industries Association
Washington, D.C. 20006
(202) 457-4925

December, 1982

LOCAL AREA TECHNICIAN SUPPLY AND DEMAND SURVEY

Electronic Industries Association (EIA); Association of Community College Trustees (ACCT)
American Association of Community and Junior Colleges (AACJC)

Dear Sir:

Your local Community of Technical College is involved as part of a nationwide survey of technician supply and demand. Your answers to this brief survey will be kept confidential and the results will be used only for aggregate statistical purposes. Thank you.

1. General information
   Location-City _____ State _____ _ Name of person completing form _____
   Phone Number (Area Code) (Number) _____
   Please check those items that apply
   a. Company with one or more subsidiaries____ b. Wholly owned firm with no subsidiaries____
   c. Describe type of business or industry engaged in by company (check one)
   ____Research and Development ____Manufacturing ____Other (give type here) _____
   d. Total Number of Employees _____ e. Total Number of Engineers Employed_____
   f. Total Number of Technicians Employed _____

2. Please list five basic skills or competencies you expect from an entry level technician regardless of job title.
   a. _____ c. _____ e. _____
   b. _____ d. _____

3. Please list any job titles other than technicians, in your company which routinely perform tasks requiring competencies and skills similar to or equal to a technician.

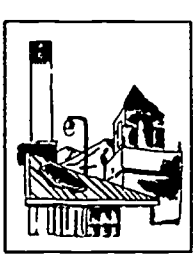
   _____ _____
   _____ _____
   _____ _____

4. What steps are you taking to alleviate shortages in those technician areas where they exist? (Please circle all that apply)

   a. improved benefits and working conditions for existing employees
   b. increased recruitment efforts
   c. obtaining training from nearby community or technical colleges
   d. paying higher wages than similar industries in the area
   e. increased in-house training
   f. use private technical schools like Devry Institute of Technology
   g. hiring temporary or part-time employees
   h. increased use of overtime work
   i. no present shortages
   j. other (write-in) _____

5. What are the causes of technician shortages in your company? (Please circle one or more and rank in priority order by putting a number beside each letter.)
   a. inappropriate training in your local area community or technical college
   b. rapid company expansion
   c. industry-wide requirements growing faster than supply
   d. insufficient output from your local area community or tech. college
   e. company located in undesirable geographic location and thus inherently difficult to recruit technicians
   f. decline in supply of new entrants
   g. other (write-in) _____
      _____

	Architectural Technician	Biomedical Technician	CAD/CAM Technician	Chemical Technician	Civil Engineering Technician	Commercial Graphic Technician	Computer Programmer Technician	Electrical Engineering Technician	Electromechanical Technician	Electronics Engineering Technician	Energy Management Technician	Environmental Science Technician	Fiber Optics Technician	Genetic Engineering Technician	Industrial Ceramics Technician	Industrial Engineering Technician	Instrumentation Technician	Manufacturi g Engineering Technician	Marine Technician	Mechanical Drafting & Design Technician	Mechanical Engineering Technician	Nuclear Technician	Occupational Safety & Health Technician	Robotics Technician	Other	Other	
6. What is your company's minimum education requirement for entry into each of the listed areas?																											
a Associate Degree																											
b Bachelors Degree																											
c equivalent military training																											
d industry in-house training certificate																											
e high school																											
f. other (write in)																											
7. Number of technicians employed (Fill the number in under each column)																											
8. Number of technicians usually employed to support one engineer or scientist (Fill the number in under each column)																											
9. Number of technicians hired in the last 12 months (Fill the number in under each column) Total hired in last 12 months _____																											
total number for replacements																											
total number for new positions																											
10. Estimate of labor supply (Place a check on the appropriate line under each column)																											
scarce																											
adequate																											
plentiful																											
11. Sources of technician supply (Fill the number in under each column)																											
up-grading of present employees																											
adequate																											
outside hiring																											



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