
Making Connections: A Regional Workforce Partnership Community Audit

Part I: Demand Side Audit Prepared

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Making Connections:
A Regional Workforce

Demand Audit

Presented to:

The Greater New Orleans Regional
Community Audit Partnership

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Preface

What is a Community Audit?

A community audit is fundamentally a strategic planning effort focused on workforce development that involves all relevant stakeholders in the issue at hand. A community audit compiles information on economic and labor market trends to support the formulation of recommendations and strategic plans and Workforce Investment Act (WIA) program operations and policy. Community audits vary in scope and purpose, depending on their precise goals.

However, all effective community audits depend on a common base of information relevant to labor demand and supply in a regional labor market. On that basis, the stakeholders can mobilize available resources to more effectively coordinate and align labor demand and supply. The purpose of a community audit is to provide useful information to key local stakeholders, which include business and industry as well as the current and future workforce, policymakers, workforce and economic development practitioners and educators. In summary, community audits consist of *strategic research* used as the basis for action plans rather than academic research.

Community audits provide stakeholders within a region with the information needed to develop a common understanding of the critical economic and social challenges confronting the region so as to be able to work in a united, cohesive fashion to develop solutions. Community audits focus not only on the *needs* of a community, but also on its *assets*.

Community audits are often initiated through the collaborative efforts of key stakeholders within a region. These partnerships typically include employers and employer organizations, unions, economic development agencies, social service agencies, community-based organizations, and educational institutions, as well as the employment and training community.

Background

The rewards of education and training represent the best-established tenets of economic development.¹ The facts concerning Louisiana's educational shortfalls are well known. At the present time, Louisiana has the highest high school dropout rate and the lowest high school completion rate in the nation.² Less well known are initiatives that are currently being implemented to overcome these shortfalls through innovative solutions formulated in response to the New Economy. The New Orleans Regional Community

¹ Source: "Economic Development in the New Millennium" Dodd and Morrison, AEDC Press, 1999

² Source: National Center for Education Statistics. Dropout rate refers to the annual percentage of students who leave school, and the completion rate refers to the number of ninth graders who graduate. The high school completion rate should be approximately four times the dropout rate.

Audit Project is an example of this. Frequently, the root cause of labor shortages lies in a lack of clear communication and standard knowledge shared by business, training and education entities and graduates. The Regional Community Audit Partnership has recognized that the course offerings of training and education providers must be aligned with the specific needs of business and industry. This audit report identifies system disconnects such the current lack of such course alignment as well as identifying the most in-demand skills needed for the Greater New Orleans region to maintain its competitiveness in the global economy. The report also outlines the occupation-specific paths that individuals can follow to obtain the skills needed to fill the most critical occupation needs within our region. To set the stage for the presentation of this information, the following facts related to general workforce development in the State of Louisiana must be reviewed for background information on our current situation:

I. Global trends mandate that we shift from economies dependant on natural resources and plentiful manual labor to knowledge-based economies. Louisiana is late in coming to this understanding. As a result, Louisiana's relative income position (state per capita income as compared to the national average per capital income) has fallen 9 percent since 1981 when the state's relative income was 89 percent of the national average; in 1999, it was 80 percent of the national average³

II. Louisiana's workforce development system is in need of repair. Recent employer surveys conducted by the Louisiana Department of Labor indicate that 50 percent of new workforce entrants lack the basic skills required to earn a middle class income.⁴ (*please refer to the chart on page 10 for further information*).

III. On the positive side, the State of Louisiana has made changes in education and workforce policy that have set the stage for significant improvements at the local level. (*See page 24 for more detail on these changes*). The Workforce Investment Boards (WIBs) that form the New Orleans Region Community Audit Partnership are aware of these improvements, however the Partnership also recognizes that employers and workers may not know what is now available.

IV. The Regional Community Audit Partnership and the four area Workforce Investment Boards (Orleans LWIA # 12, Jefferson LWIA # 11, River Parishes LWIA # 14 and Plaquemines/St. Bernard/St. Tammany LWIA # 10) need to know which high-wage, value-added occupations will be most in-demand and which specific career pathways can be mapped to successfully recruit, train and retain workers for those positions. If gaps between labor demand and supply can be bridged with qualified, trained workers, existing companies within our geographic region will enjoy greater prosperity and the region as a whole will be more successful in recruiting high-value companies.

V. At the present time, the southeastern Louisiana labor market has a serious problem, as a large number of workers are employed in relatively unskilled, low-wage jobs without

³ Source: U.S. Census Bureau

⁴ The Census Bureau does not have an official definition of "middle class," but economy.com defines middle class income as family income ranging from \$ 32,653 to \$ 48,979 per year.

significant opportunities for career advancement. Simultaneously, employers who require highly skilled workers find it increasingly difficult to recruit and retain employees with the know-how to properly perform the job.

As a result of the conditions detailed above, the four New Orleans Regional Workforce Investment Boards have contracted to work with the MetroVision Economic Development Partnership⁵ to conduct an audit of current and projected workforce shortages, workforce system gaps and assets, in-demand skill sets and training and education disconnects. **The end purpose of the audit is to provide recommendations and a framework to develop, evaluate, and implement strategies to address the workforce development issues outlined above. This project was funded by a Demonstration Project grant to the City of New Orleans from the U.S. Department of Labor.** The Department of Labor views comprehensive audits as ideal tools for WIBs to use in strategic planning.

The analysis and recommendations within this report reflect the efforts of many individuals united to address one overriding need: **to improve the standard of living for the people of the New Orleans Metropolitan Region.** This report and the recommendations charted within have been formulated to realize that vision.

Data Collection Process

In compiling this report, various stakeholders with critical interests in southeast Louisiana's present and future workforce were included as active participants in the research process. The various methods outlined in the following paragraphs were used to obtain maximum input from employers and training/education/recruitment resource providers.

1. The MetroVision Economic Development Partnership (MetroVision) and DADCO Consulting, Inc. (DADCO) compiled and analyzed data on current and future labor market trends. This data was gathered for the Greater New Orleans region as well as for the State of Louisiana and for specific prioritized, in-demand occupations in MetroVision's recognized dominant and emerging regional industry clusters. In addition, three industries not represented in those clusters, yet with significant presence in the region, were included in the cluster workshop. Empirical data on those industries is not included in this report. The industry clusters represented in this report include:

- Arts and Entertainment
- Banking and Financial Services

⁵ The MetroVision Economic Development Partnership markets 10 parishes in the New Orleans Region and Southeast Louisiana to attract new business and jobs through a broad coalition of business, education, government, labor and community organizations that seeks to enhance the quality of life and climate for commerce. Governed by an Executive Committee comprised of business and community leaders from throughout the region, MetroVision serves the parishes of Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Tammany, Tangipahoa and Washington. MetroVision is an affiliate of The New Orleans Regional Chamber of Commerce.

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- Food and Consumer Products
 - Information Technology / Environmental Technology
 - Life Sciences and Healthcare
 - Construction and Support Services
 - Petrochemical
 - Oil and Gas
 - Shipbuilding and Precision Manufacturing
 - Maritime and Transportation

2. Three series of focus groups were held for the Community Audit Project, involving over 140 business leaders, human resource professionals and career service/recruiters from throughout our region. The first group, held on 06/25/02, convened over 100 participants representative of area business, industry and policymakers. Discussions addressed cross-industry workforce issues such as employment trends, training provision, occupational shortages, in-demand skill sets and recruitment strategies.

3. In order to obtain more in-depth information to identify specific in-demand occupational skills within the dominant and emerging industry clusters, a series of interviews were held with representatives from each cluster on 08/06/02-08/07/02. The interviews provided insights into the most critical occupations that included: those hardest to recruit for, recruitment strategies, occupations hardest to train, resources used, recruitment strategies, career pathways, industry standards and industry trends. These interviews provided a clearer picture of the perceptions and attitudes of industry toward the workforce development system in southeast Louisiana.

4. The third focus group session was held on 9/12/02 with 25 representatives of various organizations involved in workforce recruitment including private agencies, One Stop Recruitment Agencies, university/community and technical college career services and the Louisiana Department of Labor. This group explored recruitment trends, disconnects and strategies geared to maximize retention of workforce of all levels within the geographic region.

Initiatives

The following strategic focus points were formulated on the basis of the findings of the Community Audit Report and research process. They will define the Regional Community Audit Partnership's strategic concentration in developing strategies to improve southeastern Louisiana's workforce development system.

1. Build and strengthen the communication channels between area industry cluster groups and education/workforce resource providers including k-12 and post-secondary education institutions.
2. Develop specific occupational skill tracks for career pathways, based on industry cluster demand that are user-friendly for employees and employers alike.

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3. Improve basic skills and work readiness skills⁶ for the future workforce as well as the current underemployed/ unemployed workers.
 4. Promote awareness of skilled trade careers to new workforce entrants as well as the underemployed/unemployed. An emphasis should be placed on actively facilitating successful educational completion, skill development and a prepared entry into the workforce for both high school and college dropouts.
 5. Expand use of assessment tools to effectively channel current and future job-seekers into career pathways for which they have an affinity, interest and experience which will facilitate success in their chosen field.
 6. Expand connections between career services/employee recruitment professionals and industry in order to streamline and otherwise improve employee placement systems and to promote the establishment of standard career pathways recognized by business and industry.

The Regional Community Audit Partnership should organize a series of working groups charged with developing action agendas to implement one of these initiatives.

Specific Recommendations

- 1. The Regional Community Audit Partnership should immediately launch a portal to provide current labor market information specific to our geographic region that can be used by area employers, Workforce Investment Boards, human resource departments, k-12 school districts, community/technical colleges & universities for curriculum planning and area jobseekers in addition to the city and parish government.**

The data on this portal should combine statistical data as well as employer-driven qualitative, anecdotal information on the regional labor market. A section within this portal through which industry, government, education, and youth service programs can communicate regularly is also an important function that should be contained within the portal.

To supplement the data contained within the portal, the Community Audit Partnership should also convene regular working group meetings with MetroVision's cluster leadership to foster personal communication and relationship building.

⁶ Basic Skills consist of the ability to read, write and perform basic mathematical equations such as addition and subtraction. Work Readiness skills are the new basic skills coupled with life skills. For further information, please refer to the Scans Skills Pyramid on page 18 of this report.

An internet-based portal should be designed to perform the following functions:

I. The ultimate goal of this portal is to have the region's industry, jobseekers, WIBs, educational institutions, service providers, and government making informed workforce decisions based on current standard, common data on regional wages, in-demand occupations, career pathways, skill standards, training/education offering and all other elements of the workforce development system. This information has the power to truly bridge existing gaps between industry, education, government, federal and state workforce funds and programs, job seekers, economic developers and a whole range of entities.

The labor market information contained within this portal will allow:

- a. Area Workforce Investment Boards, Welfare to Work and other workforce resource and planning agencies to provide clients with detailed information on in-demand occupations, certifications and industry standards required to work in these occupations and descriptions of typical duties in these occupations. The portal will also contain updated, employer-driven information on employment trends, needed skill sets and in-demand occupations so as to channel funding in the most useful, sustainable directions.
- b. Business and industry to set wages, anticipate labor demand, develop well-rounded, complete job descriptions, career pathways and industry skill standards, become aware of programs offered by the workforce development system for recruitment, training, and retention of quality employees. The site would act as a central clearinghouse for all of this information.
- c. Educational institutions from k-12 to technical and community colleges and universities, to anticipate the hiring needs of business and industry and train for those needs. Educational institutions will be able to use this portal to develop an understanding of career pathways and the needed skill sets types of training needed for in-demand careers, so that graduates of their institutions can step much more seamlessly into the working world. Educational institutions will be able to align their curriculum offering with the true needs of business and industry so that they can recruit students for in-demand programs, and place graduates in sustainable, upwardly mobile careers upon graduation.
- d. The Workforce Development system to communicate the range of programs that it offers to business and industry as well as city and parish government and economic developers.
- e. Area job seekers, unemployed, underemployed and new entrants to the workforce, will be able to access the online descriptions of position duties and certification/education requirements for in-demand occupations. One Stop staff as well as the career placement services in area technical and community colleges and universities, will be able to use these descriptions, which will also include

education levels and competency requirements, to educate job seekers on the full range of employment options that exist within our geographic region.

A successful benchmark portal, can be found at www.pprc.umsl.edu/wis/ the Greater St. Louis Region's website created and maintained by the University of Missouri at St. Louis.

Another example of an well-regarded portal with labor market information is the ERISS labor market information system (www.eriss.com). Like the University of Missouri system, ERISS uses call center technology to gather real-time data on a frequent basis to provide the region with the most reliable data possible. These two systems use a survey process to gather large amounts of primary data directly from regional industry in a minimally-invasive manner. This data is then analyzed and formatted for ready access by both companies and service/education providers.

Although the Louisiana Department of Labor has a useful statewide labor database, it does not contain the regionally focused, just-in-time information needed to meet the needs of industry. In both the cluster workshop and in interviews, not one of the industry representatives interviewed indicated that the LOIS system met all of their needs.

II. The portal should provide for continuous, dynamic communications as well as a series of interlocking operating relationships between the stakeholders. For each stakeholder, specific needs should be addressed. This can best be accomplished utilizing a "virtual office" platform. In the virtual office configuration, each industry cluster would have access to the following:

- a. A calendar of training and education courses that may be relevant to that cluster, with links to class descriptions, either on the page or on the website of the institution offering the training.
- b. A structured discussion area that may be accessed by industry, education, government, and youth service organizations to exchange information on industry needs, workforce training offerings, and open dialog on how to close gaps between the two.

These discussions should be monitored by members of the Partnership so that institutions and policy makers that can affect needed changes will be aware of both the need and potential support of these stakeholders.

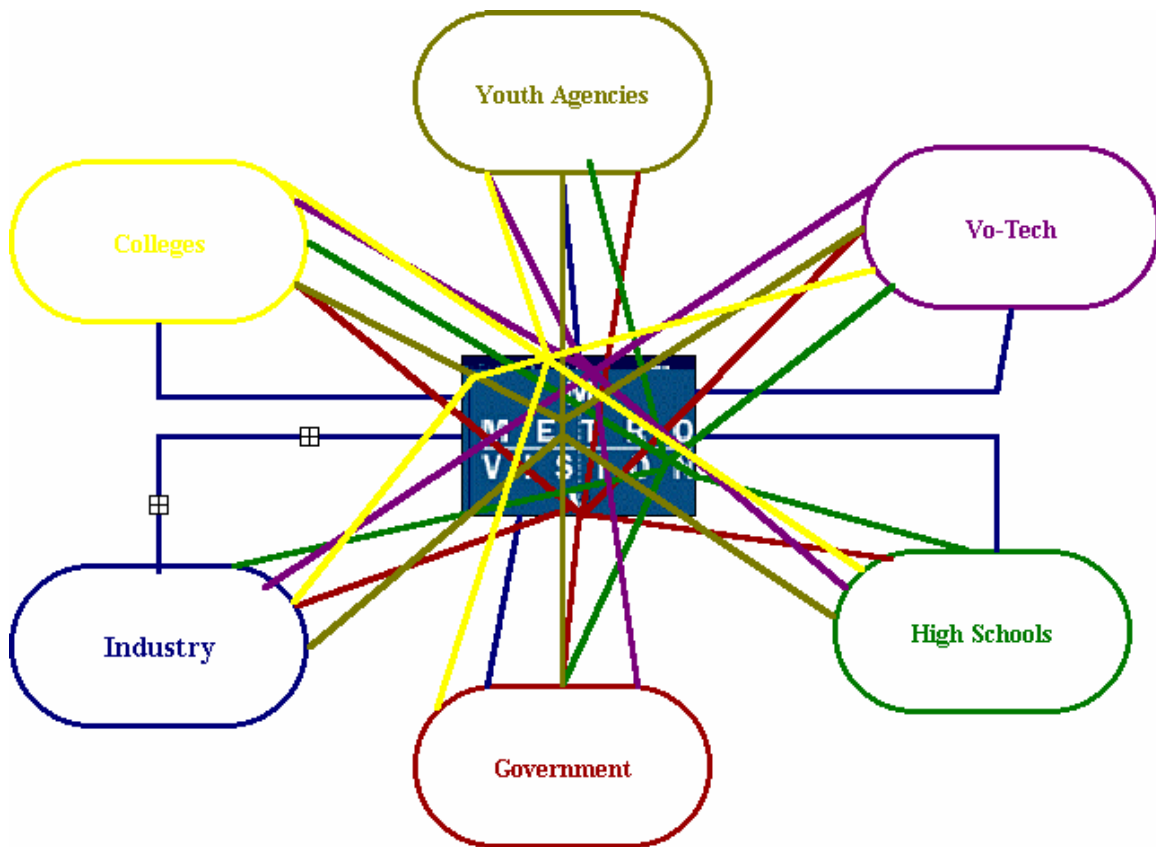
Industry representatives, whether the owner/manager of a small business or the human resources manager of larger firms, should believe that this is a place where they can express their needs and have others listen and respond, and form active partnerships to accomplish their workforce goals. For educational institutions and service providers, administrators and educators should believe that this is a place where they can find the true needs of industry, communicate their abilities and limitations, and work to develop support for policy and administrative changes that would make them more effective in meeting industry needs.

The desired end result of this portal is to connect regional stakeholders on a perpetual basis. The labor market information contained within the portal should act as a magnet, drawing stakeholders back into the portal on a regular basis, using the information on regional wages, hiring patterns, career pathways, skill standards etc. as they seek to educate, train, recruit and create jobs within the locate workforce system.

MetroVision has already organized itself around the region's dominant eight clusters, and the Partnership should develop a working partnership with MetroVision to implement and manage the communications portal. Under the Workforce Investment Act, provision has been made for investment in systems that would directly increase the ability of workforce skill providers to provide needed skills and education, and would increase the amount of private sector investment in workforce enhancement activities. A dynamic portal should meet both of these requirements.

Development of this LMI/communication portal would integrate the collaborative and market-driven principles of clusters into the goals of the workforce community audit. It would also provide the regional WIBs with constant, dynamic communication with the industries that most impact the future of the region. This action would clearly align the workforce investment boards with the industries they were designed to serve, and give the industry clusters most likely to increase wealth in the region a powerful competitive advantage. The ability of industry to communicate their needs as they arise, and have service providers and institutions respond immediately to those needs, can dramatically increase the rate of innovation, growth, profitability, employment, and wages paid by the region's industry clusters.

The development of the proposed portal and the resulting communication exchange between the stakeholders will take a considerable amount of time, energy, and money to implement. Funding for this project will have to come from a combination of Partnership member investment, industry contributions, government grants, and grants from private foundations such as the Ford Foundation, which have a particular interest in fighting poverty through economic development. A task force should be formed immediately to solicit full proposals and design layouts for the portal, and to review the existing University of Missouri at St. Louis system. These two elements should then be combined into a master proposal that could be used for fundraising purposes. The goal of the partnership should be to have the portal up and running by the first quarter of 2004.



- Members of The Regional Community Audit Partnership should become active participants in all of MetroVision’s cluster committees.** The Partnership should also begin to work with those committees to build standardized career pathways for critical occupations identified within each cluster. Cluster development, the discipline of increasing regional competitive advantage through strengthening the linkages between and among geographic concentrations of like or related industries with similar needs and market opportunities, has tremendous potential to drive effective workforce development. Because clusters foster ongoing, dynamic communication and technological development, education and skill development has been a cornerstone of the most successful regional cluster efforts worldwide. The Partnership should become an active partner throughout this process.

That involvement begins with active attendance and participation in MetroVision’s active cluster committees. A Partnership representative should contact the MetroVision staff member responsible for each cluster committee and ask for a meeting with the cluster committee chairs to explain their desire to participate and discuss the most effective way to accomplish a productive relationship with each cluster. In addition, participation in the development of a dynamic communications system would solidify the Partnership’s standing in this MetroVision initiative. Such

an action would also show industry that the Partnership has sincere desire to increase it's effectiveness and through this, the region's competitiveness.

- 3. Establish a mandate that will establish comprehensive Life Skill programs designed to ensure employability and post-training job retention, as a key precursor to technical skill training.** Life Skills training will focus on the new basic skills such as problem solving, teamwork and continuous improvement along with life skills such as communication, punctuality and work habits. In the Greater New Orleans region, the New Orleans Jobs Initiative (NOJI) has created the '21st Century Success Principals' which is a model for successful pre-technical training 'life skills' preparation. This program teaches participants the personal characteristics, work habits and coping skills such as decision making, teamwork, punctuality and internal discipline, that they need to make them excellent employees once on the job. The NOJI program also provides participants with knowledge of how to seek out resources, such as a workplace mentor, that they will need once on the job in order to guarantee their workplace success. The program introduces those who go through it to on-the-job working conditions and norms, to ensure that they will be moving into workplace situations and conditions with which they already have a working knowledge, thus promoting retention after job placement.

Looking at other models, the University of Tulsa sponsors various Life Skills workshops available to individuals throughout the community that are in need of these skills. These workshops are an excellent way for the university to train its future social workers and could be duplicated by local universities that offer graduate programs in social work such as Tulane University and Southern University at New Orleans.

Another Life Skills program recognized as a national best case model is the Shreveport, La.-based Providence House (www.providencehouseshreve.com). Providence House primarily works with homeless families to add structure to their lives through programs such as an intensive eighteen-week Life Skills curriculum that includes intensive behavior modification practices. The program has an 89 percent success rate.⁷ A survey done in 1997 found that for every \$1.00 invested in the Providence House program, \$4.00 is returned in savings to the taxpayers and \$5.00 is put back in the community through employment-generated returns.

Based on studies of the Greater New Orleans regional economy, dropouts would be one of the population segments that could most benefit from these programs.

⁷ When a family graduates from the Providence House program they are drug and alcohol free, and the parents have received their high school diploma, GED or worked in a position congruent with their highest level of ability. Some have graduated from a training/education program with an accredited local institution. The family has completed a behavior modification program geared to instill successful living skills. They have saved 50 percent of their total income earned while in Providence House, maintained two budgets, worked full-time for 90 days and have housing and furnishings to begin over again. During their time at Providence House, they have become self-sufficient in the sense that they have not received other forms of public assistance.

The partnership between the Cabinet for Workforce Development's Department for Technical Education and the Kentucky Community and Technical College System, which allows technical education students to simultaneously enroll in high school and community or technical colleges and later transfer these credits, is an excellent model which addresses career track and dropout problems. The current leaning of the government of the State of Louisiana tends towards "pay a little now for education or a lot later in the form of public assistance or corrections" –this indicates that funding for a similar program could possibly come from the public coffers.

4. **Strengthen initiatives to increase collaboration and communication between k-12 and post-secondary education institutions.** Programs such as the MetroVision School-to-Career Partnership, which exposes grammar and high school students to the range of existing career options, must be broadened in reach throughout our region and receive funding on a level commensurate with the key role that they play in the workforce development continuum.

On the post-secondary education front, an initiative must be launched to align the curriculum and scheduling options available through area universities, community and technical colleges, with the needs of the business community. The Labor Market Information Portal referred to in recommendation #1 can play a key middleman role through informing the education community of the key in-demand occupations, skill sets and competencies as reported by area business and industry so as to better orient their curriculum to fit labor demand. The relationships established between post-secondary education and business as well as the broadened skill sets of post-secondary graduates will, in turn, potentially promote the recruitment of area post-secondary graduates by area businesses and the retention these graduates within our geographic area.

5. **Convene employers to launch a massive public relations campaign that highlights rewarding careers in skilled occupations.** "The Best Careers Are Right Here!" or similarly themed campaigns could feature skilled craftsmen talking about the rewards of their career choices. The purpose of this campaign would be to 1) communicate the advantages and enhance the image of working in skilled trades and 2) promote the value of lifelong learning.
6. **Integrate the Work Keys system into the Partnership's community audit efforts.** The Work Keys system developed by ACT (formerly American College Testing, the entity which created the ACT college test) is a system that provides a framework for profiling, testing against and comparing skill levels for key positions within an industry. As detailed on their web site, www.act.org/workkeys, Work Keys functions on the 3 following levels:
 - a. Working with experienced employees, authorized Work Keys Job Profilers evaluate key skills and levels of competency required for specific jobs within a company.

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- b. Standardized Work Keys skill assessments are administered to job applicants or current employees to pinpoint their skill levels in up to eight critical areas.
 - c. Subsequently, the skill levels demonstrated by each test taker are compared to the minimum skill levels required for the profiled jobs, enabling the company to immediately evaluate a job applicant's qualifications or, in the case of a current employee, to determine that employee's training needs.

Work Keys job profiles accomplish the key task of job analysis, helping employers identify the levels of skills current and prospective employers need in order to be successful on the job. Job profiles also provide individuals with a clear picture of the skill levels that they need to qualify for and be successful in the jobs they want. Positions are profiled using a framework of eight of ten potential areas—Reading for Information, Applied Mathematics, Applied Technology, Business Writing, Listening, Locating Information, Observation, Readiness, Reading for Information, Teamwork, and Writing. Each skill is addressed by a distinct skill scale, developed with the help of businesspeople and educators. Specific jobs are then profiled according to the skill level needed for each area on a declining numerical scale, by which individual scores are compared.

The gaps between needed skill levels and individual test results allow the Work Keys test reviewer to immediately pinpoint gaps between the needed skills and current applicant skill levels. Applicants can then be placed in specific skills training modules to upgrade to the needed levels, or placed in positions that better match their current skills.

Work Keys has been successfully utilized nationwide by numerous organizations. Two examples, again provided by the Work Keys website, www.act.org/workkeys, show the variety of ways in which Work Keys works.

1. **Work Ready in Des Moines, Iowa**, provides adults who are under-prepared for work—lacking experience, academic training, or credentials— with guidance and a well-planned path to establish a new cycle of learning, improving and increasing independence. The approach involves four steps: 1) Initial Work Keys testing during Work Ready orientation 2) A two-week career exploration and job-seeking skills course using Work Keys scores and other information to develop short-term and long-term plans 3) A six-week, 120-hour curriculum designed to build the skills required for workplace success 4) A second Work Keys assessment at the end of the program.

The results? 85% of participants improved their skills, 80 percent of first-year participants are now either in college or employed in better-than-minimum-wage jobs and behavioral changes such as greater punctuality, appreciation for learning, and independence have been documented in the individuals that participated in the Work Ready process.

-
2. The **Wichita, Kansas aerospace cluster** used Work Keys as the vehicle for cooperation between business and education when Wichita's aerospace cluster saw a growing need to hire people with increasingly complex skills. Rather than import people or export jobs, the cluster decided to work with the city, schools and internally amongst the companies themselves, to expand the local skilled workforce. In 1994, the Business Education Success Team funded Work Keys as a driving force for educational reform in public and private schools. Meanwhile, Wichita employers and the Wichita Area Technical College began profiling crucial blue- and white-collar jobs in the aerospace industry. Wichita State University also began Work Keys testing for engineering seniors. In the fall of 1996, Wichita became the first school district in the country to make Work Keys testing a graduation requirement.

The results include:

- a curriculum that's better aligned with the needs of local employers, particularly in the high-wage aerospace sector
- a 100-page booklet entitled "Keys to Working in Wichita" which compares profiles of popular jobs in the cluster with students' current skill levels
- a systematic flow of hard data to measure progress in teaching job-relevant skills

The Regional Community Audit Partnership, working with MetroVision's clusters, represents the perfect vehicle for implementation of Work Keys throughout the region. Profilers and Assessors can be certified through ACT's Work Keys training program relatively inexpensively and the program is inexpensive to administer in comparison with other workforce investments. Work Keys, working through MetroVision's cluster committees, can provide the framework for dramatic and near-immediate change in the entire workforce skills system.

7. **Work to increase integration of workforce development services provided by other mandatory Workforce Investment Act Partner agencies.** The One Stop agencies and the Workforce Investment Boards should work to coordinate with partner agencies such as TANF, the Louisiana Department of Labor, and Louisiana Vocational Rehabilitation Services. This will facilitate the provision of more streamlined access to services to companies, as well as individual job seekers so that the myriad of these services will be available in one centralized location, thus reducing duplication of efforts and confusion on the part of the client as to which agency does what and where.

CHAPTER 1: The Growing Importance of Workplace Skills

Managing in Turbulent Times

One of the key characteristics of the new, global economy is the turbulence that it engenders. Companies, indeed whole industries are born and die out at an unprecedented rate. New technologies and new products based on these technologies come into being almost daily. The result of these conditions is a chaotic labor market in which:

-
- Workers have trouble getting information about career opportunities and career paths. It is often unclear where the quality jobs are and how to access them.
 - Firms struggle to find employees with the skills that they are in need of as a result of rapid changes in products and forms of production and resulting changes in needed skill sets.⁸
 - It is an extreme challenge for education and training providers to keep up with the rapid changes in the employee skill sets demanded by business and industry. They are frequently unable to do so.⁹

The Greater New Orleans regional economy has also experienced the economic churning process driven by the New Economy. Companies throughout our region and throughout the world find it necessary to adjust the quantity and skill level of their work force to stay competitive in the global economy. As a result, job elimination often occurs alongside job creation, as employers are driven by the market to discard workers that do not possess the requisite skills.¹⁰

An additional result of this churning is that some low skill manufacturing jobs are completely lost to a region when an industry is forced to become more competitive by shifting operations to a geographic region with lower production costs. Thus these jobs are often lost to countries in which the workforce is paid significantly lower wages. The dramatic decline of Louisiana's apparel industry evidences this trend. In this particular case, intensified competition and shifts in production to low-wage countries eliminated opportunities for many Louisiana families to enjoy stable incomes from companies such as Fruit of the Loom.¹¹ It is clear that the jobs of the future will require higher skill levels and more technical skills and the employees that hold these jobs will be required to continuously update their knowledge and skill sets in order to retain these jobs.

The shifts outlined in the previous paragraphs occur as companies continually strive for greater operational efficiency as well as innovation and improvements on the goods and services demanded by their clientele. Over time, a regional economy will recreate itself replacing old jobs with new ones. In the recreation process, continuous job shifting has come to be an economic fact of life. The timing and effects of the economic churning are difficult to accurately predict because of the timelines involved in implementing new technologies.¹² For example, in 1981 the U.S. Department of Labor issued a set of projections on the national job outlook. These forecasts drastically underestimated the

⁸ "Connecting with Each Other, Connecting With the Future", Commission on the Future of the South, 1998

⁹ "Thinking for a Living", Marshall and Tucker, Basic Books, 1992

¹⁰ Louisiana Department of Labor

¹¹ Fruit of the Loom left Louisiana because it stood to gain \$25 million from NAFTA Parity from Caribbean Basin Initiative countries. NAFTA Parity gives duty-free status to certain exports from Caribbean Basin Initiative countries. The same sources have said that Fruit of the Loom pays its Honduran workers \$3.50 a day to perform the same types of jobs. This clearly illustrates the shift of the United States away from a labor-intensive economy towards one based on knowledge. Source: Public Citizen.

¹² Mass Customization, Pine, Harvard Business School Press, 1993

speed at which the personal computer would take over the workplace, and as a consequence, the projections failed to anticipate the explosion in market demand for software, computer engineers, and computer technicians. Meanwhile, these same forecasts significantly overestimated the demand for typists.¹³ Clearly, the U.S. Department of Labor emphasized the continuation of routine jobs based on an outdated economic model. The same could quite feasibly be true with the latest employment forecast from the federal and state labor departments.

By adopting innovations and continuously upgrading the skills of their employees, companies are able to improve productivity. Put simply, to improve bottom-line margins and remain competitive, companies must create more for less. Yet with these improvements in overall productivity, earnings rise for individual employees possessing the operational know-how necessary for their jobs, as well as for the company. Thus through the churning, companies become more competitive and workers gain higher living standards. At the same time, job losses are inevitable. It is through this cycle of job creation and destruction that a region will ultimately realize the rewards of increased employment, higher-level jobs and higher overall living standards.¹⁴

Technology does not allow an economy to stand still. Innovation and competition drive the churning. New ideas, new products, new markets, and new organizations demand new skills. As the churning goes on, it raises living standards. Clearly, this is a difficult idea to grasp for someone who has recently lost a job.

Like much of the South, the Greater New Orleans region has been affected by these massive economic shifts. Considered as a unit, the economy of the southeastern United States has undergone a remarkable transformation. From a Depression era “basket case,” the southeastern United States now represents one of the largest economic regions in the world. The ten largest global economies are displayed in the following table. The Bureau of Economic Analysis states that the combined gross state product of the southeastern states of the United States is \$2,156 billion, which makes it the world’s fourth largest economic system, after the rest of the United States, China, and Japan.¹⁵

The roots of the South's economic strength lie in the growth of manufacturing in the region. Beginning in World War II, the Southern states began to attract manufacturing investment in the form of facilities of production.¹⁶ The Greater New Orleans region has experienced part of this growth through the impact of companies such as Martin Marietta (the present-day Lockheed Martin Space Systems Company), Avondale Shipyards (the present-day Northrop Grumman Ship Systems) and International Paper (now Gaylord).

¹³ U.S. Department of Labor

¹⁴ *New Rules for the New Economy*, Kevin Kelley, Penguin Press, 2000

¹⁵ “Connecting With Each Other, Connecting With the Future” Commission on the Future of the South, 1998

¹⁶ “Economic Development in the New Millennium” Dodd and Morrison, AEDC Press, 1999

The World's Ten Largest Economies

American South: \$2.156 bn

No	Nation	GDP
1	United States	\$ 9,299 bln.
2	China	4,800 bln.
3	Japan	2,950 bln.
4	Germany	1,864 bln.
5	India	1,805 bln.
6	France	1,373 bln.
7	United Kingdom	1,290 bln.
8	Italy	1,212 bln.
9	Brazil	1,057 bln.
10	Mexico	866 bln.

Source: The Political Reference Almanac

These companies have hugely impacted the region through the creation of thousands of jobs.

Because of improvements in logistics, the reduction of trade barriers, and the telecommunications revolution, companies now find themselves competing in an entirely new environment. The old factors that drove manufacturing investment—low cost land, labor and utilities—are still important, but they are not the only factors for investment today. Work in the Greater New Orleans region will no longer be based on repetitive manual tasks, as these jobs have gone (or will probably go) to other countries. Work in the Greater New Orleans region will become learning. In today's environment, the most competitive companies across the country are taking nothing for granted. They question everything—every strategy, every process, and every figure. They pursue quality by relentlessly reinventing themselves. This process demands workers who are capable of continuously learning new and more efficient ways of doing their jobs.

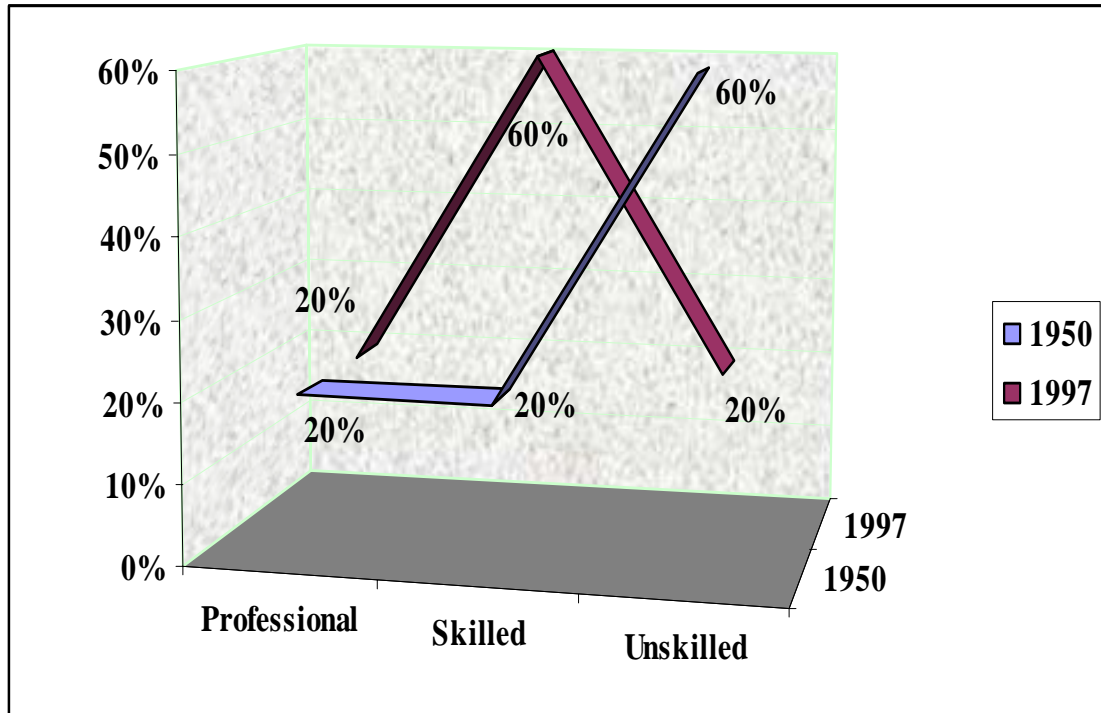
Increasingly, successful companies are trying to build highly decentralized networks of management that empower all employees to think for themselves, experiment, and innovate. Workers who are capable of meeting these challenges are rewarded better than those who cannot. As a consequence, we have seen in recent years a growing gap between the incomes of high-school graduates and people with post secondary education. A college degree does not signify the mastery of a particular set of technologies so much as it indicates an individual has mastered the work habits needed for the New Economy.

The speed of transformation in local economies in southeast Louisiana and around the United States has the associated effect of creating critical information gaps. Simultaneously, in the new, highly competitive global economy, the efficient and effective functioning of the labor market is more important than ever before. Testifying before Congress, Federal Reserve Chairman Alan Greenspan stated, “the single most important factor in our economic recovery is the productivity of our nation’s labor

force.”¹⁷ Timely, accurate and detailed information is the first step in addressing this problem.

Comparison of Professional, Skilled, and Unskilled National Workforce

Source: “21st Century Skills for a 21st Century Economy



The future is not just about mastering new technologies. We have some idea of what new technologies a worker will need to know ten years into the future, but we do not know all of them. We have little idea of which inventions will disrupt the status quo. (Indeed, we live in a world in which a 19 year-old college student can invent a technology—Napster—that overnight disrupts a multi-billion dollar recording industry.)

The future is about skills and preparing people with successful work habits for the New Economy. Successful workers in the years ahead will commit to—and be rewarded for—continuous learning. They will need to be adaptable, innovative people who can move confidently within an economic environment that is continuously shifting. The workforce development system will need to instill quality work skills. That is the only way students can meet their inevitable challenges with confidence and thrive in the economy ahead. We will explore these critical work skills in more detail in Chapter 2 - they begin with mastering the basics of reading and math.

¹⁷ Alan Greenspan’s Testimony Before Senate Commerce Committee as covered by CNBC, June, 2002

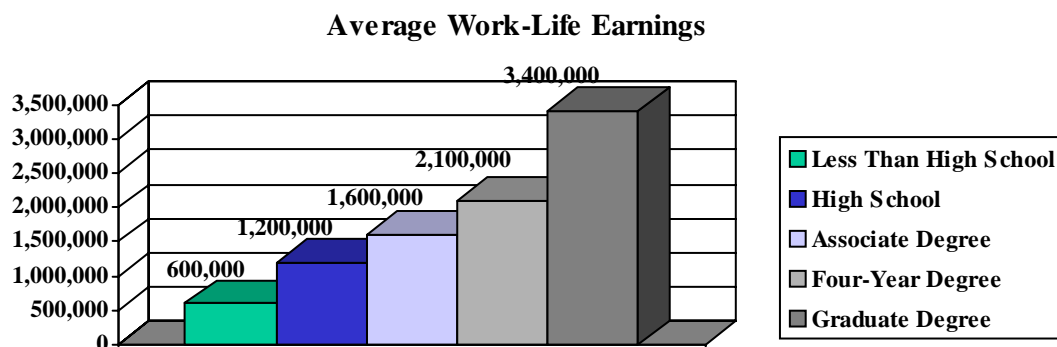
CHAPTER 2: Understanding the Dynamics of Workforce Development

With the 1983 government publication of *Nation at Risk: The Imperative for Educational Reform*, our national leadership began to recognize that the U.S. education and workforce development system is dramatically disconnected from the emerging trends of the New Economy. Since the 1980s, the economy has raced ahead, while the education system has lagged behind. Despite efforts at educational improvement, our economy is still moving ahead exponentially, while educational reforms are moving incrementally.¹⁸

Like the rest of the country, the firms in the Greater New Orleans region that experience success in this new economic order will have placed a premium on recruiting and retaining workers capable of mastering the challenges of the new economic environment. The region needs to build a more globally oriented, networked workforce development system that encourages ongoing, dynamic communication and cooperation between workforce training/education/service providers and the companies in need of those skills.

The demand for higher skilled jobs is the result of technological advancements in some industries as well as the relocation of low-skilled manufacturing jobs to countries with lower production costs. These changes have had the inevitable effect of creating major shifts in work life. These changes, taken individually or as a whole, carry significant implications for education and workforce development. The most significant implications are as follows:

- A future of poverty faces those workers without at least a mastery of ninth grade math and reading skills
- Increasingly bleak prospects are on the horizon for people whose education has not progressed beyond high school

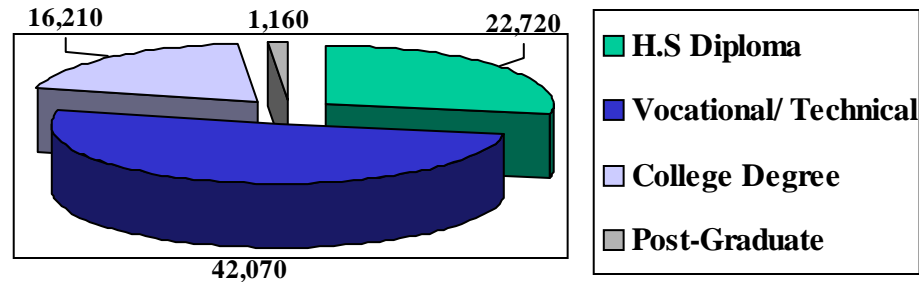


Source: US Census Bureau

¹⁸ “The Future of Education in Montana,” Economic Development Action Group, March, 2002

- Increasing numbers of workers will require post-secondary technical training

Projected Openings by Minimum Educational Requirements, 1998-2008, New Orleans LMA



Source: Louisiana Department of Labor

- A worker's lifetime careers will include more moves, transitions and occupational changes than those of any previous generation
- Increasingly, high value-added companies will depend on collaboration and alliances with educational institutions and other training facilities to recruit and retain qualified workers
- Because companies must now continually adapt to new markets and opportunities, career paths have become less clear. The future is no longer a given.
- Employees must take charge of their own careers. In the end, the only job security comes from being able to learn quickly new and increasingly complex skills

The New Basic Skills

Earning a middle class living requires two sets of skills: 'Life Skills' and 'New Basic Skills.' In an ideal world, a solid K-12 education should provide both. However, the real world situation is that large percentage¹⁹ of students are either dropping out or completing high school without the necessary skills required to earn a middle class income.²⁰ Indeed, many graduate from high school unprepared for post-secondary education, either. For example, within the Louisiana State University system, approximately 65 percent of entering freshmen must take remedial courses.²¹

Many parents view college as critical to acquiring the skills to earn at least a middle class living in the New Economy. After all, the wages of high-school graduates have fallen

¹⁹ According to the Louisiana Workforce Commission, cumulatively, between 9th grade and 12th grade, approximately 40 percent of the students in southeast Louisiana leave school.

²⁰ The Census Bureau does not have an official definition of "middle class." Other publications such as economy.com define middle class income as family income ranging from \$ 32,653 to \$ 48,979 per year.

²¹ Source: La. Board of Regents

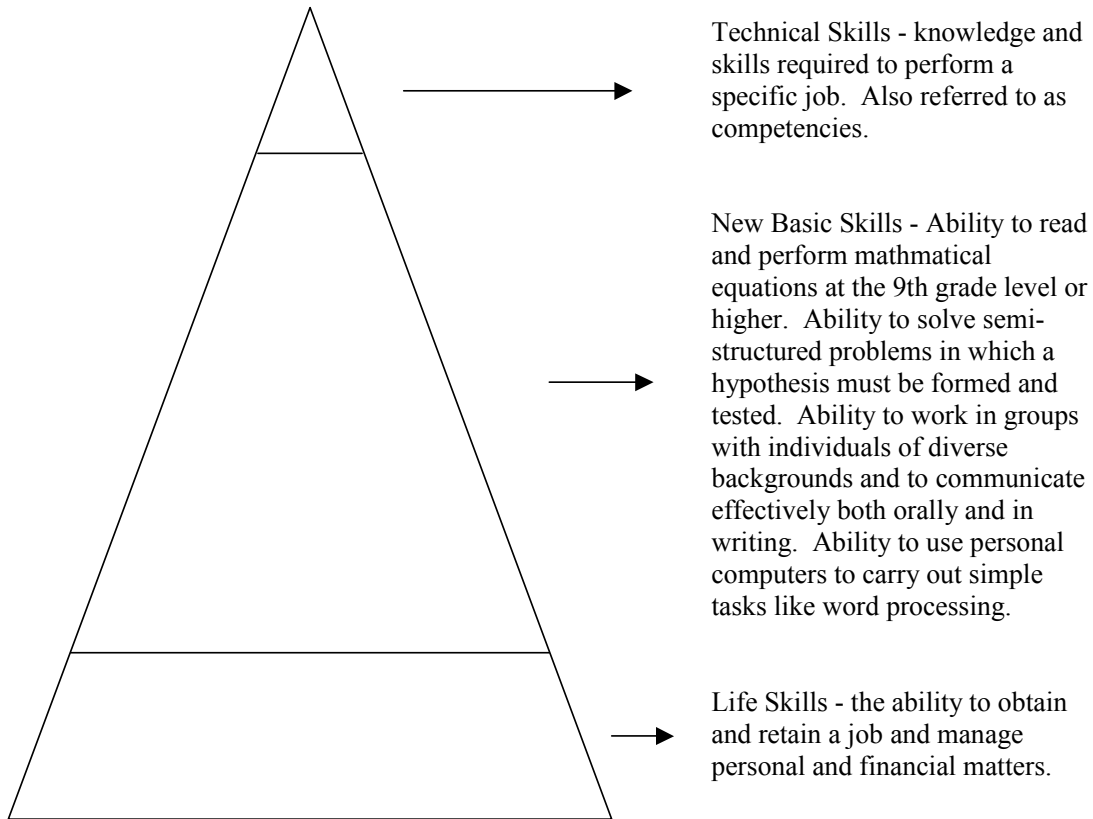
over the past fifteen years. At the same time, the wages of college graduates have increased. Parents understandably conclude that good jobs are now so complex they require a college degree. But there is good reason to think they are wrong.

In reality, employers may reward college graduates for different motives. They have come to learn that a high-school diploma is no guarantee that an applicant can comprehend basic reading or perform basic mathematical operations. A college student is more likely to have mastered these skills. Employers may be turning to college graduates as much for basic skills as for the more advanced and specialized knowledge that they have acquired in college.

How do we prepare for this New Economy in which jobs are less permanent than skills? Nearly ten years ago, the George H. W. Bush Administration convened leaders from the business community to focus on this question. The Secretary's Commission on Achieving Necessary Skills ("SCANS") issued a report that outlined the skills that young people need to succeed in the working world. Starting with the fundamentals of reading, writing, and math, the New Basic Skills include personal and interpersonal qualities and thinking skills.

The pyramid outlined in the following graphic illustrates the challenge of building workplace skills.

The SCANs Skills Pyramid²²



Life skills form the base of the pyramid and are required to obtain and hold jobs ranging from entry-level to the top leadership positions of multinational corporations. These habits and behavior involve personal management, such as the ability to show up at work on time. They include personal qualities of honesty and integrity. They extend to the ability to manage a simple personal or family budget. They also include the ability to interact productively with other people. Based on what was learned in the focus groups and interviews, employers are finding more and more young people who do not possess these minimum Life Skills necessary to secure and retain a job.

In addition to these Life Skills, today's workers need to master the New Basic Skills. Reading at a ninth grade level and performing mathematical operations at a ninth grade level are the cornerstones. One or both of these skills play a direct role in three additional

²² Secretary's Commission on Achieving Necessary Skills, 1990

capabilities: solving problems, communicating (orally and in writing) and using a computer for word-processing and other office tasks. The sixth skill involves the ability to collaborate in diverse groups. High-school students are usually not evaluated on this full mix of factors, but they are tested in reading and math. The test results across the country present a difficult situation. According to a recent review by ACT as a part of their Work Keys program, as many as half of 17 year-olds surveyed cannot read or perform mathematical operations at a level needed to get a job at a modern automobile plant.

On top of New Basic Skills, employees need Technical Skills to advance in their careers. These in-demand Technical Skills are resulting in an increased demand for post-secondary technical education. As the U.S. Department of Labor points out, in the knowledge-based economy of the 21st century, some formal post secondary education will be a prerequisite for continuous economic advancement. Our system of post secondary education will need retooling to meet this demand. Necessary changes include:

- Accommodation for a higher percentage of better prepared high-school students who want to pursue post secondary education
- Additional technical training programs — a form of “Just in Time” training —to meet shortages of skilled workers in particular companies and industries
- Enough flexibility to meet the needs of adults who want to remain up-to-date in their field, change careers or upgrade their skill sets

The SCANs Skills Pyramid and the Greater New Orleans region

The New Basic Skills can be broken down into two distinct groups: Hard Skills and Soft Skills.

HARD SKILLS	SOFT SKILLS
Reading	Working in Groups
Writing	Making effective oral presentations
Basic Mathematics	Taking initiative
Problem Solving	Learning from and correcting mistakes
Understanding Computers and Technology	Giving and receiving feedback
	Thinking creatively

Source: American Youth Policy Forum

The following tables demonstrate the New Basic Skills and how they apply to specific jobs within the industry clusters that dominate in the Greater New Orleans region.

An “X” denotes that the New Basic Skill is required for the job. The skills required to perform these jobs were obtained from a variety of sources that include the U.S. Department of Labor, the U.S. Bureau of Labor Statistics, the Louisiana Department of Labor and the employers who hire workers to fill these positions.

		Oil and Gas						
		Petroleum Engineer	Geologists	Drill Operators	Petroleum Technician	Surveyors	Mapping Scientists	Roughnecks
NEW BASIC SKILLS								
HARD SKILLS								
Reading		X	X	X	X	X	X	X
Writing		X	X	X	X	X	X	
Basic Mathematics		X	X	X	X	X	X	
Problem Solving		X	X	X	X	X	X	X
Understanding Computers and Technology		X	X	X	X	X	X	
SOFT SKILLS								
Working in Groups		X	X	X	X	X	X	X
Making effective oral presentations		X	X			X	X	
Taking initiative		X	X	X	X	X	X	X
Learning from and correcting mistakes		X	X	X	X	X	X	X
Giving and receiving feedback		X	X	X	X	X	X	X
Thinking creatively		X	X	X	X	X	X	

Tourism/Entertainment

NEW BASIC SKILLS	Food Service Managers	Lodging Managers	Food Preparation Workers	Wait Staff	Food Service	Porters	Production Crew Members	Gaffers/Grips	Sound Technician
	HARD SKILLS								
Reading	X	X	X	X	X	X	X	X	X
Writing	X	X	X	X	X	X	X	X	X
Basic Mathematics	X	X	X	X	X	X	X	X	X
Problem Solving	X	X	X	X	X	X	X	X	X
Understanding Computers and Technology	X	X			X		X	X	X
SOFT SKILLS									
Working in Groups	X	X	X	X	X	X	X	X	X
Making effective oral presentations	X	X		X					
Taking initiative	X	X	X	X	X	X	X	X	X
Learning from and correcting mistakes	X	X	X	X	X	X	X	X	X
Giving and receiving feedback	X	X	X	X	X	X	X	X	X
Thinking creatively	X	X	X				X	X	X

Maritime Cluster

NEW BASIC SKILLS	Vessel Captains	Seamen	Shipping Clerks	Ship Mates	Transport Supervisors	Cleaners	Mechanics
	HARD SKILLS						
Reading	X	X	X	X	X	X	X
Writing	X	X	X	X	X		X
Basic Mathematics	X		X	X	X		X
Problem Solving	X	X	X	X	X		X
Understanding Computers and Technology	X		X	X	X		X
SOFT SKILLS							
Working in Groups	X	X	X	X	X	X	X
Making effective oral presentations	X				X		
Taking initiative	X	X	X	X	X	X	X
Learning from and correcting mistakes	X	X	X	X	X	X	X
Giving and receiving feedback	X	X	X	X	X	X	X
Thinking creatively	X		X	X	X		X

Petrochemical Cluster

	Equipment Operators	Maintenance Workers	Chemical Mechanics	Process Engineers	Process Operators
NEW BASIC SKILLS					
HARD SKILLS					
Reading	X	X	X	X	X
Writing	X	X	X	X	X
Basic Mathematics	X	X	X	X	X
Problem Solving	X	X	X	X	X
Understanding Computers and Technology	X	X	X	X	X
SOFT SKILLS					
Working in Groups	X	X	X	X	X
Making effective oral presentations				X	
Taking initiative	X	X	X	X	X
Learning from and correcting mistakes	X	X	X	X	X
Giving and receiving feedback	X	X	X	X	X
Thinking creatively	X	X	X	X	X

Shipbuilding

	Welders	Sheet Metal Machinists	Workers	Millwright	Pipefitter	Mechanic
NEW BASIC SKILLS						
HARD SKILLS						
Reading	X	X	X	X	X	X
Writing	X	X	X	X	X	X
Basic Mathematics	X	X	X	X	X	X
Problem Solving	X	X	X	X	X	X
Understanding Computers and Technology	X	X	X	X	X	X
SOFT SKILLS						
Working in Groups	X	X	X	X	X	X
Making effective oral presentations						
Taking initiative	X	X	X	X	X	X
Learning from and correcting mistakes	X	X	X	X	X	X
Giving and receiving feedback	X	X	X	X	X	X
Thinking creatively	X	X	X	X	X	X

Warehousing/Distribution

	Truck Drivers	Packers	Mechanics	Dispatchers
NEW BASIC SKILLS				
HARD SKILLS				
Reading	X	X	X	X
Writing	X	X	X	X
Basic Mathematics	X		X	
Problem Solving	X	X	X	X
Understanding Computers and Technology	X		X	X
SOFT SKILLS				
Working in Groups		X	X	
Making effective oral presentations				X
Taking initiative	X	X	X	X
Learning from and correcting mistakes	X	X	X	X
Giving and receiving feedback	X	X	X	X
Thinking creatively	X		X	

Food and Consumer Products

	Systems Operators	Process Engineers	Systems Maintenance	Line Operator	Maintenance Workers	Shift Supervisor
NEW BASIC SKILLS						
HARD SKILLS						
Reading	X	X	X	X	X	X
Writing	X	X	X	X	X	X
Basic Mathematics	X	X	X	X	X	X
Problem Solving	X	X	X	X	X	X
Understanding Computers and Technology	X	X	X	X	X	X
SOFT SKILLS						
Working in Groups	X	X	X	X	X	X
Making effective oral presentations	X	X	X			X
Taking initiative	X	X	X	X	X	X
Learning from and correcting mistakes	X	X	X	X	X	X
Giving and receiving feedback	X	X	X	X	X	X
Thinking creatively	X	X	X		X	X

Information Technology/E-Commerce

NEW BASIC SKILLS

	Systems Analysts	Computer Programmers	Computer Support Specialist	Installers/Repairers
HARD SKILLS				
Reading	X	X	X	X
Writing	X	X	X	X
Basic Mathematics	X	X	X	X
Problem Solving	X	X	X	X
Understanding Computers and Technology	X	X	X	X
SOFT SKILLS				
Working in Groups	X	X	X	X
Making effective oral presentations	X	X	X	X
Taking initiative	X	X	X	X
Learning from and correcting mistakes	X	X	X	X
Giving and receiving feedback	X	X	X	X
Thinking creatively	X	X	X	X

Life Sciences

NEW BASIC SKILLS

	Home health worker	Medical Re-Nurses	Physician's Assistant	
HARD SKILLS				
Reading	X	X	X	X
Writing	X	X	X	X
Basic Mathematics	X	X	X	X
Problem Solving		X	X	X
Understanding Computers and Technology		X	X	X
SOFT SKILLS				
Working in Groups	X	X	X	X
Making effective oral presentations		X	X	X
Taking initiative	X	X	X	X
Learning from and correcting mistakes	X	X	X	X
Giving and receiving feedback	X	X	X	X
Thinking creatively		X	X	X

There are fifty-two distinct positions identified in the preceding review of the New Basic Skills for New Orleans Region industry clusters. The following tables summarize how vital New Basic Skills are to specific positions (identified in the preceding tables) among the industry clusters in the Greater New Orleans region.

Percentage of Jobs in the Region Requiring "Hard" New Basic Skills

Reading	100%
Writing	98%
Basic Mathematics	87%
Problem Solving	96%
Understanding Computers and Technology	87%

Percentage of Jobs in the Region Requiring "Soft" New Basic Skills

Working in Groups	96%
Making effective oral presentations	40%
Taking initiative	100%
Learning from and correcting mistakes	100%
Giving and receiving feedback	100%
Thinking creatively	81%

Every position identified requires that the workforce that fills these positions be able to read, take initiative, learn from and correct mistakes and give and receive feedback.

In summary, in order for workers to be successful in the knowledge-based economy, they must be able to:

- Read at the ninth grade level or higher
- Perform math at the ninth grade level or higher
- Solve the semi-structured problems in which a hypothesis must be formed and tested
- Work in groups with individuals of diverse backgrounds
- Use personal computers to carry out simple tasks like word processing and spreadsheet operations
- Communicate effectively, both orally and in writing

For employers, problems associated with finding an adequate supply of workers invested with these skills has become increasingly complex. Myriad programs, incentives and initiatives promise to provide assistance yet significant numbers of employers large and small remain confused. The Workforce Investment Act was designed to reduce confusion and streamline workforce development resources by bringing industry and resource providers together to solve these issues. The WIBs that comprise the Regional Community Audit Partnership are dedicated to making that initiative a reality. But frustration and lack of information continues to impede those efforts.

Key findings of the focus group are as follows:

- “We need three things from our employees: Creativity, Problem Solving, and Energy.”
- “Company employees do not seem to grasp the concept of teamwork”
- “Our workers need to learn about the benefits of doing the right thing.”
- “We had 400 applicants for a job. Less than 40 could pass a simple reading comprehension test.”
- “Our applicants need more writing skills, business skills and soft skills.”
- “Entry-level workers do not possess teamwork skills.”
- “Workers are often late and leave early. They need to learn the value of punctuality to *their careers*”
- “Our employees do not have a sense of responsibility. They do not take responsibility for their actions.”
- “Our workers need human relations and interpersonal skills. They need presentation skills and written communication skills.”
- “Our employees are in need of life skills. They have no grasp of the concept of work and reward, and it hurts them as well as our company.”

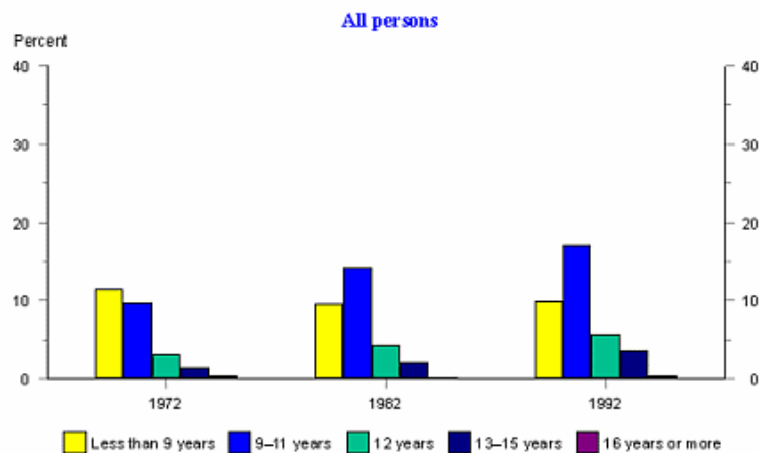
Throughout their comments, employers stress the importance of the New Basic Skills. But they are communicating something more. Many prospective employees lack the fundamental personal traits (“Life Skills”) needed to secure and retain a job. Frustrations over basic work ethics and “life skills” are echoed throughout the above comments of area employers. A recent survey by the Louisiana Department of Labor indicated that 75 percent of respondents commented that secondary and technical schools in the state should have work ethic courses. They cite a wide range of inter-related problems. Among the most frequent comments were:

- “Employees have bad attitudes”
- “Employees have poor expectations of work...Don't know what work is all about”
- “Employees need life planning skills”
- “Employees need to teach loyalty and patience”
- “Employees are not trustworthy”
- “Employees have poor manners and business etiquette.”
- “Employees have weak personal accountability”

The Workforce Development System

In evaluating effectiveness in meeting the needs of both employers and employees, it is necessary to consider education and work force as part of the broader system which starts with K - 12 education. According to the latest data available from the U.S. Census Bureau, high school dropouts are nearly three times as likely as high school graduates who did not go on to college to receive income from Aid to Families with Dependent Children (AFDC or Welfare) or other types of public assistance (17 percent versus 6 percent).

Indicator 32-1: Percentage of persons 25–34 years old who received income from AFDC or public assistance, by years of schooling completed: 1972–92



Source: U.S. Census Bureau

This presents a clear opportunity to organize structured outreach programs to untapped populations within our labor market area. This includes high school-aged youth – high school graduates who have not or will not continue onto a college or university as well as high school dropouts. A large number of young people stay in school but graduate from high school with no clear career plan. They enter the entry-level work cycle or routine jobs with low pay. Frequently, they are unable to advance out of jobs of this level, and they become trapped in a cycle of low wages. They become the working poor. The American Community Survey conducted by the United States Census Bureau from 1999 through 2000 found that Louisiana has the highest poverty rate in the nation, with 20.3 percent of state residents living below the poverty level. The Federal Government’s definition of poverty is pre-tax income, including government cash transfers, below \$17,601 in 2000 for a family of four.²³ Here is a bird’s eye view of the formation of this imbalance within the education and training system.

(i) There are too many young people who do not complete high school and enter the dependency cycle at some point during their late teens.

(ii) There are also too many high school graduates—between 30 percent and 50 percent — who come out of school with New Basic Skills so weak that they cannot get a career-oriented job²⁵. (The previous is a national statistic, but given Louisiana’s low public education scores on many aspects, we can reasonably assume that the local figures are on the high end of this spectrum.) These individuals overload the regional entry-level job cycle and become candidates for the working poor.

(iii) This leaves too few young people capable of entering a sustainable and rewarding career track. Even those continuing on to college face difficulties. As many as half need some remedial help, and one-third of college freshmen entering Louisiana colleges and universities drop out after their first year.²⁷

There is very strong evidence that Louisiana has a very high number of “working poor,” as was indicated in the 1999-2000 American Community Study conducted by the U.S. Census Bureau. This study found that while Louisiana has the highest poverty rate in the nation, our state ranks a respectable 17th in public assistance payments. The seeming discrepancy between Louisiana’s respectable rank for public assistance payments and the high poverty rate is strong evidence that the poor in Louisiana are not supported by the social welfare programs, but by low paying/low skill jobs.

In contrast, yet another category is comprised of high school graduates who graduate from high school with some type of career plan. They will pursue either post-secondary education or the military. In some rare cases they may enter an apprenticeship type job

²³ Source: United States Bureau of the Census

²⁵ High School and the New Jobs: Ralph Whitehead, Jr., 1997

²⁷ Source: Board of Regents

that is the starting point on a career pathway. These workers are heading down a career track with opportunities for advancement. Unfortunately, however, far too many Louisiana youth do not enter pathways such as these get there right away. A few statistics illustrate that the southeast Louisiana education and workforce system is seriously out of balance. Louisiana has the highest dropout rate in the country. According to the National Center for Educational Statistics, only 61.1 percent of students entering ninth grade will earn a high school diploma. An additional 1.5 percent will earn a GED at some point after dropping out of high school.

At the same time, only about 60 percent of high-school graduates are moving on to college.²⁸ That means large numbers of students are entering the work force at the entry level. In the Greater New Orleans region, we have identified the following groups of people who exit the education system before completing college and the likely problems that they may face.

Group	Problem
Dropouts High School Graduates College Dropouts	Very weak or no New Basic Skills. Possible weak or limited New Basic Skills with no career track. No career track

This large percentage of individuals entering the regional workforce at the entry level with no career track causes the wages at the bottom of the scale to stagnate or decline. Our education system is not training enough people with a combination of New Basic Skills and Technical Skills to meet the needs of local employers. Thus employers complain that they cannot find the skilled workers that they need. This creates a large-scale problem for local companies competing in the global arena. Directly and indirectly, these companies ultimately pay multiple times for basic skills, once in the form of taxes that fund the public education system, again through workforce training programs and yet again as a result of operational inefficiencies caused by a lack of New Basic Skills.

Workforce development in the State of Louisiana is moving forward on multiple levels. In recent years, comprehensive educational reforms have established rigorous standards for primary and secondary schools. The new Community and Technical College System provide the potential for a vibrant community college system. And post secondary colleges and universities, under the reorganized system, have begun to cooperate in unprecedented ways.

Among the most notable changes in the educational arena is the introduction of the Tuition Opportunity Program for Students (TOPS), a comprehensive program of state scholarships which has been hailed as one of the most innovative and progressive student assistance programs in the nation. In short, TOPS provides the funding to make college

²⁸ Source: Louisiana Board of Regents

³⁰ Source: Louisiana Department of Education

education a reality for many lower income students in Louisiana. As evidenced by the results, this programs acts as an incentive for students to take more interest in their studies. Since the program was implemented in 1997, the State of Louisiana high school dropout rate has decreased from 8.8 percent in 1996 to 5.9 percent in 2000.³⁰ Considering these short term program results, we cannot help but speculate that in the long term Louisiana could ultimately see an economic boom similar to that experienced in the United States during the 1950s partially resulting from the long-term benefits of the GI Bill that made a college education a reality for vast numbers of military personnel after World War II.

Progress is being made on the high school level as well through programs such as The School-to-Career Partnership housed with the MetroVision Economic Development Partnership of The New Orleans Regional Chamber of Commerce. The School-to-Career Partnership and its business partners provide financial, materials and supplies, and in-kind support to some 68 academies in 38 area high schools in seven school districts, as well as 13 whole school change sites.

The Partnership has directly involved 1207 teachers in professional development internships that increase their awareness of the skills and knowledge required by business and industry today, thus enabling them to integrate their core curriculum with lessons that are relevant in the work place. Over 30,000 students have benefited over the past seven years from innovations in curriculum, mentoring, shadowing, internships, and post-secondary linkages in industries supported by the seven School to-Career consortia of Architecture, Design, Engineering, and Construction & Chemical; Culinary Arts/Food Service; Financial Services; Healthcare; Hospitality, Travel, & Tourism; Information Technology and Law & Justice Careers. The School-to-Career Partnership is a national model for self-determination of the emerging workforce that matches student aptitude and interest with the demands of the market.³¹

Critical however, to the success of systems such as these are initiatives to sharply curtail high school drop out rates within our state. In 2000, 19,813 students in Louisiana dropped out of high school,³² the greatest concentration leaving in their ninth grade year. The number of dropouts within Jefferson and Orleans Parishes accounted for 4,467 of the total dropouts. Governor Foster has appointed the Secondary School Redesign Committee that has developed recommendations for changes to keep more students in school. The premise that these recommendations are based on is simple. In the long-term, it ultimately costs more in future dollars spent on welfare and corrections than it does implement programs to reduce high school dropouts and allow individuals to earn sustainable incomes through jobs that they have the skills and preparation to take on.

The National Drop Out Prevention Center at Clemson University (www.dropoutprevention.org) also provides some useful models to follow. These models target such key elements as family intervention, early childhood education,

³¹ Source: "Birth of a Partnership", Metrovision School-to-Career Program

³² Source: Louisiana Department of Education

reading/writing programs, mentoring/tutoring, service learning, alternative schooling, and out of school experiences.

Summary Observations on the Workforce Development System in Louisiana

- We expect young people to move from K-12 education into a career cycle.
- In the past, a high school education guaranteed a middle class income,³⁴ but this is no longer the case.
- Career pathways in the new economy must include some form of post-secondary education.
- Contemporary society has traditionally supported the 4-year college model but it has become increasingly clear that post-secondary training lasting less than 4 years is appropriate for many young people. Only about 25 percent of young people get a 4-year degree.³⁵
- One-third of entering college freshmen do not return to finish their degrees.³⁶
- An average high school counselor has over 200 students to advise.³⁷
- The working poor do not have the New Basic Skills to climb out of the minimum-wage cycle.
- Too often, high-school dropouts, the underemployed and working poor do not have needed flexible, practical work-based education options.
- Skill demands for rewarding career pathways are increasing.
- Individuals in the working poor cycle have avoided dependency on the government welfare system but they cannot easily get the skills they need to advance.
- Rebalancing requires: 1) reducing drop-outs 2) improving the teaching of New Basic Skills during the high school years 3) providing more flexible post-secondary education to provide technical skills.
- Adult basic education will move individuals out of the working poor cycle and provide business and industry with greater quantities of skilled workers.

³⁴ The Census Bureau does not have an official definition of “middle class.” Other publications such as economy.com define middle class income as family income ranging from \$ 32,653 to \$ 48,979 per year.

³⁵ Source: Board of Regents

³⁶ Source: Board of Regents

³⁷ Source: Louisiana Department of Education

Successful Benchmarks

One need not look far for examples of success in workforce development and education. A great deal of information is readily available on best practices in every area of the field. A few outstanding examples:

The Schuyler/Steuben/Chemung WIB in upstate New York. After the implementation of the Workforce Investment Act and the tremendous growth of Corning Industries and the resulting development of a glass/fiber optic cluster in the region, the WIB needed a plan and effective implementation. The WIB staff was dedicated, but new to WIA's entrepreneurial bent and freedom of choice. Industry was cynical, saying that the process was simply putting "new paint on an old car." Leadership rested with the Economic Development professionals on the Board. They understood the opportunity, and the risks of failure in addressing workforce needs. The entire board wanted a dynamic, ongoing connection with industry, but didn't know the right approach. The answer was found in developing a new communications tool. Stskills.com is an interactive site that utilizes "conversational technology" developed for Hewlett Packard. The site was designed to be an:

- Internet-based multi-faceted survey (answers to initial questions take users down one of many "decision trees" that replicate an actual conversation).
- Instant summary that provides graphic analysis of the respondent as well as the overall group.
- Answer to very specific needs/issues through linking with the WIB and regional Economic Development groups. The community is utilizing the site to compile labor market information.
- Participation was driven by e-mail solicitation with additional promotion from Economic Development groups.
- A promise was made by Economic Development groups to produce results, including a labor market report and providing skill development programming

In Kentucky, a new partnership between the Cabinet for Workforce Development's Department for Technical Education and the Kentucky Community and Technical College System ("KCTCS") allows technical education students to simultaneously enroll in high school and community or technical colleges. "Kentucky Tech students now have the opportunity to earn KCTCS credit while in high school, transfer that to any of the 28 community and technical colleges and not miss a beat in their education" said Governor Paul Patton. Students can transfer credit from KCTCS programs directly to the University of Kentucky System, providing a seamless pathway to move from secondary education through technical and collegiate and even into post-graduate opportunities. In the 2001 school year, more than 24,000 students were enrolled in 33 Kentucky Tech schools that serve 127 of the state's school districts.

In St Louis, the Construction Careers Center, a taxpayer-funded charter school controlled by local construction companies, provides students with hands-on training and experience. They combine a traditional curriculum with at least one hour of actual construction experience. To satisfy union concerns, students are encouraged to enter apprenticeship programs after graduation. Others continue on to college, where they compliment their hands-on experience with a degree in construction management. But even those who do not receive a diploma are still endowed with skills and experience can have earning power exceeding \$30 per hour. The construction companies have invested close to \$6 million in equipping the school.

The development of these best case practices sets the stage for other schools to excel. Education reform works. We only need to study the cases of Texas and North Carolina to see the impact of reform. The remarkable rate of math performance gains in North Carolina and Texas stems from the integrated set of policies involving standards, assessment and accountability that these two states implemented in the late 1980s and early 1990s. A recent review of the Rand Corporation demonstrates that educational performance can be improved even in high poverty districts. The Education Trust has also outlined how 366 high poverty schools have excelled by implementing standards, high expectations and accountability in the classroom. (for further information, please refer to “*Dispelling the Myth: High Poverty Schools Exceeding Expectations*” at <http://www.edtrust.org/pubs-online.html>.)

Based in Shreveport, the Alliance for Education is a new organization funded through private donations which acts as a clearing-house of support for local schools in Caddo and Bossier parishes. The Alliance is conducting a leadership institute to bring principals from the two parishes together to share ideas and improve their leadership skills. The Alliance is patterned after a successful program in Seattle where local businesses support schools through additional dollars, volunteers and programs. The Alliance will focus on three major areas: Professional Development for teachers and principals; identifying and expanding programs that work and matching qualified individuals from throughout the the community with school needs.

The Community College Research Center at Columbia University examined industry clusters in which 2-year colleges inventoried the training needs of dominant regional clusters and aligned their offerings so as to directly influence the performance of companies within the cluster. The 2-year branch of West Virginia University in Parkersburg offers special programs and faculty expertise to the locally dominant chemical processing industry. In Nelson, New Zealand, home to 60 percent of that country’s seafood processing and exporting, a branch of the local polytechnical institute which targets fisheries and marine technology, attracts students from all over the South Pacific. Catawba Community College in Hickory, North Carolina, a regional hub serving three fifths of the United States hosiery industry, operates the only hosiery technology center in the nation. In Ayr, Scotland, the technical college has special programs and services for the region’s growing electronics industry. Springfield Technical Community College in Massachusetts, which is located in a region historically dominated by the

machine tool industry, helps to maintain needed skill levels with programs and services designed and delivered in cooperation with the National Tooling and Machining Association. Alabama Southern Community College has established a special center for the regionally prominent chemical processing and pulp-and-paper industries. Each of these colleges has responded to the needs of the dominant and emerging industries in its own region.

Equally important is the need to slow the flow of young people into the dependency cycle. The National Drop Out Prevention Center at Clemson University (www.dropoutprevention.org) provides some useful models to follow such as family intervention, early childhood education, reading/writing programs, mentoring/tutoring, service learning, alternative schooling, and out of school experiences. In 2000, 19,813 students in Louisiana dropped out of school,⁴⁰ and most were in ninth grade. (Jefferson and Orleans Parish dropout accounted for 4,467 of the total dropouts).⁴¹ Governor Foster has appointed the Secondary School Redesign Committee that has suggested changes to keep more students in school. The basic idea is simple. It costs more in welfare and corrections than it does to reduce high school dropouts.

Currently, the State of Louisiana is in the process of establishing electronic networks that will allow students to attend classes anytime, anywhere. Learning can take place at work, at community learning centers and even shopping centers. Distance learning has the highest penetration in large corporations and post-secondary educational institutions. Businesses can get the latest technical training delivered to them over the Internet.⁴² While the full impact that these developments will have on education has yet to be felt, the effectiveness of distance learning systems and services has already been confirmed. As a result of recent technology developments, the effectiveness of distance learning has been greatly enhanced by a variety of new products. The Louisiana Board of Regents recently won an award from the Smithsonian Institution in Washington for the state's new electronic distance learning network. This system connects all state colleges and universities, many K - 12 schools, the New Orleans-based LSU Health Science Centers and 15 Louisiana National Guard sites. Plans also call for the state's college campuses to join in the network. In less than two years, the network has grown from 42 college courses and 630 students to more than 6,700 students and 360 courses.

Summary of Workforce Dynamics

- The low-skilled, low-paying jobs that the underemployed and working poor become trapped in encompass roughly 40 percent of the overall job market.⁴³ This percentage will decrease as low skill manufacturing jobs are lost to developing nations. The remaining jobs will require more rigorous training. Approximately 10 to 15 percent of

⁴⁰ Source: Louisiana Department of Education

⁴¹ Source: Louisiana Department of Education

⁴² Source: Louisiana Workforce Commission, 1999

⁴³ Source: U.S. Bureau of Labor Statistics

these jobs will require up to a year of on-the-job experience and informal training. Ordinarily, this type of training is provided by a combination of post-secondary technical courses and workplace-based on-the-job training.

- This means that a significant portion of the new jobs will require more formal technical training or a combination of technical training and work experience. About half of these remaining jobs will require a bachelors' degree at minimum and in some cases other additional education.⁴⁴
- While ready and willing to assist, businesses are confused and frustrated by the myriad programs and services available to assist them in hiring the most productive workforce. There is an unclear division and overlapping territory between what employers need, what institutions provide and what services the WIBs can offer. The good news and bad news is that the disconnect is primarily caused by a lack of communication. In order to be effective, communication channels must be structured, delivered and continuously maintained. **Improving communication is the primary challenge.**

In addition to the communications disconnect, other major initiatives must be launched such as:

1. Development of specific career pathways outlined in partnership with industry. Too many industries do not have clear career pathways defined, ultimately resulting in too little utilization of available workforce skill development tools.
2. Improvements made to New Basic Skills, Life Skills, and Work Readiness Training. Depending on the parish, generally between 20 percent and 40 percent of Louisiana high school students do not pass the high school exit exam in mathematics.⁴⁵ Employers also overwhelmingly cite the lack of work ethics, communication skills and teamwork abilities as primary weaknesses in the system.
3. Expansion of the workforce system's efforts to prevent dropouts and guide those that have already dropped out back into the system. Simultaneously, career pathways for non-baccalaureate post-technical training options must be developed and promoted. Nationally, 45 percent of all college students are enrolled in two-year courses of study. In the Southern states, 44 percent of all college students are enrolled in two-year colleges. In Louisiana, only 17 percent attend two-year colleges.⁴⁶

⁴⁴ This means that a significant portion of the new jobs will require more formal technical training or a combination of technical training and work experience. According to the Bureau of Labor Statistics, of the twenty-five highest paying, fastest growing occupations between 1996 and 2006, (on the national level) eighteen of them require at least a four year degree. These twenty-five occupations are somewhat concentrated, with five occupations in computer technology, four in health care, and five in education. The 25 occupations with the largest and fastest growth in employment, as well as higher than average pay and lower than average unemployment, will account for 5 million new jobs, or 27 percent of all job growth. Source: U.S. Bureau of Labor Statistics.

⁴⁵ Source: Louisiana Department of Education

⁴⁶ Source: National Center for Education Statistics

With these points as a backdrop, we can now review the structure under which this workforce development initiative will operate that is the main focus of this study.

CHAPTER 3: The Regional Community Audit Partnership

The report that follows is that commissioned by the 4 Greater New Orleans Region WIBs that comprise the Regional Community Audit Project. This Partnership is formed by the WIBs representing the parishes of Orleans, Jefferson, St. Tammany, St. Bernard, Plaquemines, St. John, St. James and St. Charles. In launching this regional effort, the WIBs seek to serve as a bridge to connect the labor market to the labor force through labor market profiling. The purpose of this project is to expand the capacity of the local partners and the regional working groups through long-term strategic planning efforts geared to effectively address the needs of the regional labor market exchange system.

The ultimate goal of the Regional Community Audit Partnership is to develop regional workforce investment policy, funding plans, outreach mechanisms and workforce development programs based on a regional analytic framework. As such, the Project includes both demand and supply side objectives as outlined below:

1. Develop of baseline data on the regional labor market demand including:
 - Quantitative analysis of the structure and composition of the regional economy
 - Data on current and projected in-demand occupations and skill sets and industry standards
 - Development of user-friendly, clear career pathways for prioritized, in-demand occupations
 - Geographic mapping of industry cluster concentrations
 - Chart of gaps and assets in the regional training and education system
 - Analysis of wages and skills associated with key growth industries in the regional economy
 - Qualitative investigation of trends in industry recruitment and employment systems
2. Development of baseline data on the regional labor market supply including:
 - Quantitative analysis of the labor force structure and trends
 - Identification of labor force assets, gaps and barriers

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- Geographic mapping of untapped pockets of unemployed and underemployed workforce
 - Mapping of employment and training resource base
 - Mapping of supportive services resource base
3. Development of data sets to support industry cluster-based strategies for the regional labor market plan.
 4. Participation as a peer in a national "peer learning network" and identification and sharing of best case practices in workforce development initiatives.

The Regional Community Audit Partnership also plans for long-term outcomes of the process to include development of regional skill standards and career ladders in key industry sectors through intergovernmental cooperation and collaboration with regional employers.

CHAPTER 4: Cluster Demand Research and Cluster Workshop

The geographic area at hand has been designated Louisiana Labor Market Area #1; it encompasses a population of over 1.2 million persons. This region houses a very diverse population with dissimilar parochial issues; many critical barriers to workforce development exist.

For the workforce development system to be successful, the new economic reality requires that it foster continuous, dynamic and open communication amongst all of the stakeholders. It also requires flexibility, creativity and changing the often-negative perceptions that employers and employees hold towards governmental workforce development tools. Results are the only acceptable outcome. According to the manuscript on workforce challenges entitled "*21st Century Skills for 21st Century Jobs*"⁴⁷ a multitude of data demonstrates that increased education and training pay large dividends. For example:

- Employers that provide formal training for their employees see a 15 to 20 percent average increase in productivity.⁴⁸
- Overall, workers with more education enjoy greater benefits, experience less

⁴⁷ The U.S. Department of Commerce, U.S. Department of Labor, U.S. Department of Education, National Literacy Project, and the Small Business Administration published this manuscript in 1999.

⁴⁸ Source: "*21st Century Skills for 21st Century Jobs*"

unemployment, and, when dislocated from their jobs, reenter the workforce with significantly more ease than those with less education. For example, dislocated workers with a high school diploma take nearly twice as long to find a new job as those with an associate degree.⁴⁹

Within the Greater New Orleans region these facts have even greater meaning. Our region has one of the lowest wage rates and highest poverty levels of all major metropolitan areas in the United States.⁵⁰ Forming new partnerships and configuring existing partnerships in new ways will be critical to the region's efforts to change those figures. If we do not take these steps, the risks of continually lower wages and higher poverty are substantial. This Community Audit is a first step in that process. The new economic reality is profound and permanent; it will take consistent effort to achieve success in it.

Worldwide Trends in Mature and Emerging Industries

The changes described in the preceding section have required that all industries change and adapt. For mature industries, the adaptation of technology into every facet of the operations of a company within that industry, has become essential. According to “Economic Development in the New Millennium,” a guidebook published by the American Economic Development Council and co-authored by the author of this report, the adaptation of technology requires that every company be classified as “high tech” if it expects to survive. Over 90 percent of the site location executives and consultants surveyed in that report said that workforce skills and availability of technology were the top concerns of their clients. The mature industries represented in this survey all recognized that to remain competitive, they must have a workforce that can easily adapt to new technology and the new processes that it mandates. In the Greater New Orleans region, traditional industries such as Oil and Gas, Petrochemical, Maritime and Food Manufacturing have rapidly adapted new technology and many are experiencing severe shortage of workers capable of operating this new technology. A fundamental challenge but one vital to overcome in providing skills and occupational training for these industries is overcoming the cynicism that has set in about the ability of the workforce system to provide those.

In emerging industries such as biotechnology and distributed communication technology, these skills are even more important. The breakthrough discoveries and new innovations that impact not only these industries but all others must be developed and produced by highly adaptable, motivated, knowledgeable workers at all levels, from upper management to line employees. The development of these industries in the Greater New Orleans region has lagged most major metropolitan areas. The region's ability to catch up in these industries is extremely dependent on instilling high-level capabilities within its workforce.

In traditional as well as emerging industries, the ability of educators and workforce

⁴⁹ Source: U.S. Department of Labor.

⁵⁰ Source: U.S. Department of Labor and U.S. Census Bureau.

training providers to adapt quickly and provide needed skills *at or before* the point at which they become critical is an absolute. For employers, their willingness to fight preconceived notions and reach out to providers with information on a consistent basis can be the key to success. This Community Audit plays the role of intermediary in this process, in attempting to assess and link needs and services, and develop an ongoing system of communication and interaction that will ideally continue and increase in strength. For MetroVision's industry clusters, these issues are even more critical. **The Greater New Orleans region is placing the bulk of its economic future in the hands of mature industries. To succeed, each cluster must identify and provide very specific information on their skill needs so that training and education providers can respond.**

Industry Concentrations and MetroVision Cluster Initiatives

Regional economies have become increasingly dependent on the ability of their companies to innovate and increase productivity. Beginning in the late 1980s, economists began to evaluate regions and determine the factors that allowed some to be more dynamic, resilient and successful at creating wealth than others. Several factors were identified as keys to success, including a responsive public sector; investments in infrastructure and in some cases, climate and location. However, one factor recurred in all the successful regions: firms in these regions had stronger connections, closer relationships and successfully cooperated with one another even as they competed vigorously.

This revelation led to the development of a new discipline in economic development and many regions began to attempt to quantify and promote the development of *clusters*, geographic concentrations of like or related firms with active channels of communication and innovation. These clusters tended to form around “social capital” which is a measurement of the strength of formal and informal linkages between firms within a region. These firms tended to be more innovative, more productive, and achieved higher value for their products and services than those that did not collaborate.

In the Greater New Orleans region, the recognition of this discipline has led the MetroVision Economic Development Partnership to engage in a major initiative focused around nine leading clusters that represent both mature and emerging industries. Those clusters include the following:

- Arts and Entertainment
- Environmental Technology
- Food and Consumer Products
- Information Technology
- Life Sciences
- Maritime Transportation
- Oil and Gas
- Petrochemical
- Healthcare

Each of these clusters has formed committees comprised of leading companies that have committed to increase mutual collaboration. MetroVision believes that through engaging these industries as active partners in the economic development process, encouraging their cooperation in addressing needs and opportunities, they will in turn become more competitive, profitable and will assist in bringing in complimentary and related firms to grow the region's economic base.

A critical component of collaborative activity is workforce skill development. Clusters tend to actively address workforce skill issues and often take joint actions independent of workforce resource providers. MetroVision's goal is to connect these clusters with the activities of the Regional Community Audit Partnership and increase the use of the Partnership's resources while leveraging those resources in the most efficient way possible through intra-industry collaborative activity. The development of this collaboration is one of the primary end goals of the Community Audit. The following information on employment trends and growth forecasts for clusters within the region is meant to serve as a guide for the Partnership to gauge needed activity and progress toward meeting and exceeding growth in skills and wages relative to national and comparative regional indexes. The final portion of this report is taken from a cross-cluster workshop held on June 25, 2002 in which leaders of these clusters and support industries were asked to relate current and future needs and perceptions of skill and service providers. Together, these components set a stake in the ground for the development of effective strategies to ensure New Orleans' regional growth and prosperity.

Review of Industrialization and Specialization Scan

As a major component of the cluster initiative, an industrial and specialization scan was performed to gauge the relative concentration and strength of industry clusters in the Greater New Orleans region. The results of this research illustrate the relative occupational demand in the cluster industries and are useful in looking at the combination of concentration and growth among specific industries and their occupations. This data will be utilized in the cluster leadership interviews and will be used to gauge actual demand versus demand as perceived by the clusters. The following outline describes the methodology used and summarizes findings from the scan.

The scan was organized into five sections:

1. Background on Methodology and Measurement
2. Overview on Key Trends Suggesting Advantages
3. Benchmarks for Cluster Strengths and Weaknesses and Detailed Analysis of National Benchmarking
4. One-Page 'Capsules' Summarizing Findings
5. Conclusion with Appendices, Documentation and Analysis.

The MetroVision research staff are to be commended for their work on this section of the report. Summary information on the labor market in the Greater New Orleans region is

as follows:

- The Greater New Orleans region is fairly diversified, in that no single business employs more than 10 percent of the total employed population.
- The three largest industry clusters as determined by the number of firms are: eating/drinking establishments within the hospitality sector, health services and business services.
- The only employment gain in manufacturing from 1989 through 1999 was experienced by the Industrial Machinery industry.
- The largest employment losses from 1989 through 1999 were experienced by the Oil/Gas (net loss of 5024 employees), Water Transport (3606), Transportation and Equipment (1,843) industries.
- There was little job growth in the low wage employment sectors.

Location Quotient (Concentration) Analysis

The Location Quotient Technique is the most commonly utilized economic base analysis method. Location quotients are calculated for all industries to determine whether or not the local economy has a greater share of each industry than expected when compared to a reference economy.

For example, suppose that 5 percent of the workforce of a local economy is employed in computer manufacturing and the national economy has only 0.05 percent of its workforce in computer manufacturing. This technique assumes that the local economy would have that same percentage of its workers in the computer manufacturing industry to serve its local needs for computers. Any employment over and above the expected percentage (in this case 0.05 percent) is therefore considered to consist of basic sector jobs because these workers are assumed to be exporting their goods and services to non-local areas. If the percentages had been identical or if the local percentage had been less than the reference percentage, then the analyst would conclude that the local area has no basic sector employment for that industry as the area can only, at best, meet their local demand and not export these goods and services.

- $LQ < 1.0$ = All Employment is Non-Basic

A LQ that is less than one suggests that local employment is less than was expected for a given industry. Therefore, that industry is not even meeting local demand for a given good or service. Therefore all of this employment is considered non-basic by definition.

- $A LQ = 1.0$ = All Employment is Non-Basic

A LQ that is equal to one suggests that the local employment is exactly sufficient to meet the local demand for a given good or service. Therefore, all of this employment is also

considered non-basic because none of these goods or services are exported to non-local areas.

- A LQ > 1.0 = Some Employment is Basic

A LQ that is greater than one provides evidence of basic employment for a given industry. When an LQ > 1.0, the analyst concludes that local employment is greater than expected and it is therefore assumed that this "extra" employment is basic. These extra jobs then must export their goods and services to non-local areas, which, by definition, make them Basic sector employment.

The location quotients for the following clusters are as follows:⁵¹

	Maritime Employment Cluster		All Industries Total Employment	LQ
Region	12,530	divided by	644,870	0.01943
USA	70,000		130,000,000	0.000538
				36.0848

	Entertainment (Excluding Tourism) Employment Cluster		All Industries Total Employment	LQ
Region	47,030	divided by	644,870	0.072929
USA	8,114,000		130,000,000	0.062415
				1.16845

	Life Sciences Employment Cluster		All Industries Total Employment	LQ
Region	61,650	divided by	644,870	0.095601
USA	11,065,000		130,000,000	0.085115
				1.12319

	Petrochemical Employment Cluster		All Industries Total Employment	LQ
Region	13,240	divided by	644,870	0.020531
USA	723,000		130,000,000	0.005562
				3.69165

⁵¹ All data from this section was taken from data compiled by the U.S. Bureau of Labor Statistics and the Louisiana Department of Labor.

	Warehousing / Distribution Employment Cluster		All Industries Total Employment	LQ
Region	9,860	divided by	644,870	0.01529
USA	1,856,000		130,000,000	0.014277
				1.07095

	Food and Consumer Products Employment Cluster		All Industries Total Employment	LQ
Region	5,860	divided by	644,870	0.009087
USA	1,684,000		130,000,000	0.012954
				0.7015

	Information Technology / e Commerce Employment Cluster		All Industries Total Employment	LQ
Region	6,060	divided by	644,870	0.009397
USA	2,095,000		130,000,000	0.016115
				0.58312

Note: The Louisiana Department of Labor did not list actual employment in an “information technology” segment of the regional labor market, and the 6,060 figure used for the location quotient calculation is based on employment under the listing entitled “communications.”

Reviewing the above location quotients, the most surprising was the warehousing distribution location quotient of 1.07. With the transportation and warehousing resources available in the region, this cluster should be doing more than “servicing the local industry” which is what the location quotient indicated.

The only cluster with location quotients less than one were:

- Food and Consumer Products
- Information Technology / e-Commerce

High concentration/employment and number of establishments are characteristic of the following industries:

- Ship Building
- Water transportation and freight
- Towing and tugboat services, cargo handling
- Petroleum refining, pipelines, field services
- Industrial organic and inorganic chemicals
- Food and beverage products
- Roasted coffee, distilled wine, fresh and frozen fish

If the Greater New Orleans region is create its share of the jobs strong enough to support the technology needs of local industries by local information technology firms, a stronger workforce must be created to handle this work, as the current location quotient indicates that 42 percent of the information technology jobs needed to support the local base employment are held by firms located outside of the region. Improving this location quotient will be one of the measures of success of the initiatives and recommendations, as the future of workforce employment mandates a shift to a knowledge-based economy.

The oil and gas, petrochemical and maritime clusters have the highest location quotients, as these industries produce products that are used outside of the Greater New Orleans region. These industries are very important to the regional economy however, most of the job growth in these industries will consist of skilled positions that reflect the “knowledge economy.” These industries must have a skilled labor pool to recruit from if they are to efficiently utilize their huge investments in the Greater New Orleans region.

The strategic clusters, or those that have lesser mass but are critically important to the competitive future of the Greater New Orleans region in terms of having the highest job creation potential and the most value to other clusters are:

- Environmental Technology
- Information Technology
- Life Sciences
- Arts/Entertainment (excluding tourism)

In the scan, we identified four additional notable clusters:

- Aerospace (low concentration)
- Aluminum (small but growing rapidly)
- Stone, Clay, and Glass Products (high but declining)
- Precision Manufacturing (ships)

The scan also identified eight technology-intensive cluster benchmarks that resulted in three value-chain or labor relationships:

- Chemicals and Plastics
- IT and Instruments
- Pharmaceuticals and Medical Technologies

Projected Growth Forecasts and Wage Comparisons for Regional Clusters

In addition to specialization and concentration data, the MetroVision Research Department also conducted a comparative analyses of wage structures in key cluster occupations. DADCO research compiled occupational growth forecasts from the Louisiana Department of Labor and Federal Bureau of Labor Statistics.

This information, combined with the qualitative, anecdotal information gained through the June 25 Workforce Forum with area business leaders, provides a solid foundation of information with which to outline the following industry outlooks as well as wage and growth data for each of the clusters.

Oil and Gas Cluster

The oil and gas cluster has long been a significant employer in the Greater New Orleans region due to plentiful onshore and offshore oil reserves and the many service industries that support the exploration and production companies. The price of crude oil is the engine that drives the energy industry. In the late 1990s, in the wake of the Asian economic downturn, oil prices sank to \$10 a barrel. This slump drove many small independent exploration companies into bankruptcy and some larger oil companies into mergers. Subsequently, drilling activities were curtailed, causing a ripple effect: oil service companies (contract drillers, well maintenance firms and others) had fewer rigs to service; pipeline and storage companies had less oil and gas to transport and store and refineries produced less gasoline.

But in 2000 oil prices again soared to as much as \$30 a barrel and the industry rebounded. The recovery came after the OPEC cartel restricted production causing world demand to drive prices dramatically upwards. The higher oil prices trickled down to reach most of the industry (producers, refiners, pipeline companies, equipment makers, oil field service providers and gas station operators), which all experienced increased profits. Leading the charge were the world's largest integrated oil companies: Exxon Mobil, Royal Dutch/Shell and British Petroleum/Amoco. But aggressive independent exploration and production companies such as Apache and Devon Energy also were also well positioned to take advantage of higher energy prices.

The industry began to play catch-up, trying to develop untapped oil and gas fields, accelerate production and store more refined products. Simultaneously, pressure from environmental regulators for cleaner-burning gasoline increased refining costs. Increased demand for natural gas to fuel power plants encouraged more exploration for that resource as well which has created additional business for natural gas transporters and marketers such as Dynegy and El Paso Energy.

Despite a recent increase in exploration and production spending, oil and gas companies fear the cyclical nature of the market and hesitate to scuttle cost-cutting measures initiated after the last oil price crash. Reinforcing their fears is Sheikh Ahmed Zaki

Yamani, the former Saudi oil minister who helped lead OPEC's oil embargo in the 1970s. Predicting an oil price collapse within the next few years, Yamani sees new discoveries (in the Caspian Sea, Africa, and Yemen) and enhanced drilling technology (especially deepwater drilling in the Gulf of Mexico and offshore Brazil) leading to vast new reserves and greater supply which will in turn weaken demand.

Already a weak global economy and reduced industrial and consumer demand, especially in the wake of the September 11, 2001 terrorist attacks in the US, deflated oil prices and led to oil surpluses worldwide, curbing the industry-wide momentum of the previous year. Thus at present, the volatility and unpredictable future of this industry make labor demand somewhat unstable and difficult to predict with certainty.

Key Occupations

The key occupations within this industry cluster in the Greater New Orleans region are: Petroleum Engineers, Geologists, Drill Operators, Petroleum Technicians, and Surveyors/Mapping Scientists. Many of the management and financial occupations are located in Houston.

Experience gained in many oil and gas extraction jobs can be transferred to various other industries. For example, roustabouts can move to construction jobs, while machinery operators and repair people can transfer to other industries with similar machinery. Geologists and engineers may become involved with environmental activities, especially those related to this industry.

Wages

Overall, the industry pays above average earnings in professional positions such as engineers and technical blue-collar positions. The earnings are equal or below earnings in non-technical blue-collar jobs (with the exception of the drilling segment of the industry) nationally, but comparable to other southern metro areas. Professional wages are moderately to extensively higher as a result of the cluster activity.

Employment Changes (National):

According to the U.S. Bureau of Labor Statistics, the oil and gas extraction industry, with about 311,000 salaried jobs in 2000, is the largest industry in the mining division, accounting for more than one-half of national mining employment. The workforce is divided between two segments: 1) Crude petroleum and natural gas and the related natural gas liquids, with about 129,000 jobs and 2) Oil and gas field support services account for about 182,000 jobs.⁵²

Although onshore oil and gas extraction establishments are found in 48 States, over 75 percent of the industry's workers in 2000 were located in just four States—California,

⁵² U.S. Bureau of Labor Statistics

Louisiana, Oklahoma, and Texas. While most workers are employed on land, many work at offshore sites. Although they are not included in employment figures for this industry, many Americans are employed by oil companies at locations in Africa, the North Sea, the Far East, the Middle East, South America and countries of the former Soviet Union.

Approximately 7 out of 10 establishments employ fewer than 10 workers, although more than half of all workers in this industry work in establishments with 50 or more workers. As more large domestic oil and gas fields are depleted, major oil companies are focusing their exploration and production activity in foreign countries. Consequently, smaller companies with less capital for foreign exploration and production are drilling an increasing share of domestic oil and gas. Technology also has significantly decreased the risk and cost for smaller producers. Almost 64 percent of the workers in this industry are between 35 and 54 years of age.⁵³

⁵³ Source: U.S. Bureau of Labor Statistics

Employment of wage and salary workers in oil and gas extraction by occupation, 2000 and projected change, 2000-10			
(Employment in thousands)			
Occupation	Employment, 2000		Percent change, 2000-10
	Number	Percent	
All occupations	311	100	-7.3
Management, business, and financial occupations	39	12.6	-11.5
Financial managers	3	0.9	-11.5
General and operations managers	12	3.9	-9.9
Accountants and auditors	7	2.1	-14.6
Professional and related occupations	35	11.3	-11.1
Computer specialists	4	1.2	4.2
Petroleum engineers	6	1.8	-17.4
Drafters, engineering, and mapping technicians	3	1	-7.9
Geoscientists, except hydrologists and geographers	6	1.8	-11.4
Geological and petroleum technicians	5	1.5	-8
Office and administrative support occupations	40	13	-17.9
Bookkeeping, accounting, and auditing clerks	8	2.5	-23.9
Information and record clerks	4	1.4	-25
Material recording, scheduling, dispatching, and distributing occupations	4	1.2	0.7
Office clerks, general	6	1.9	-6.1
Executive secretaries and administrative assistants	5	1.6	-16.1
Secretaries, except legal, medical, and executive	8	2.6	-26.6
Construction and extraction occupations	108	34.7	-4.8
First-line supervisors/managers of construction trades and extraction workers	10	3.2	0.6
Derrick operators, oil and gas	12	3.7	3.1
Rotary drill operators, oil and gas	12	3.8	-12.6
Service unit operators, oil, gas, and mining	9	3	-4.3
Helpers.Extraction workers	11	3.4	-12.3
Roustabouts, oil and gas	33	10.6	-6.6
Installation, maintenance, and repair occupations	19	6	0.2
Vehicle and mobile equipment mechanics, installers, and repairers	3	0.9	3.4
Industrial machinery mechanics	3	1	-4.4
Maintenance and repair workers, general	3	0.9	-12.1
Riggers	5	1.5	10.8
Production occupations	28	8.9	-1.3
First-line supervisors/managers of production and operating workers	3	0.9	-15.8
Welders, cutters, solderers, and brazers	9	2.8	9.2
Petroleum pump system operators, refinery operators, and gaugers	8	2.5	-3.6
Transportation and material moving occupations	38	12.2	-3.6
Truck drivers, heavy and tractor-trailer	9	2.9	7.1
Crane and tower operators	3	0.9	0.4
Laborers and freight, stock, and material movers, hand	4	1.4	-13.6
Pump operators, except wellhead pumpers	3	1	-8.5
Wellhead pumpers	11	3.6	-8.7

NOTE: May not add to totals due to omission of occupations with small employment.

Source: U.S. Bureau of Labor Statistics.

Employment Changes (Regional):

The Louisiana Department of Labor is predicting a net loss of jobs for this cluster; however, industry officials predict that there will be growth in demand for the skilled positions. The following table identifies the growth/decline in employment in key occupations of the cluster.

Petroleum engineers +.02%,
Roustabouts -0.4%
Natural Science Computer Programmers +3.2%
Service Unit Operators +2.1%
Drill Operators +2.0%

The Louisiana Department of Labor predicts that the oil and gas cluster in the Greater New Orleans region will lose 3,330 jobs, or 23 percent of the workforce between 1998 and 2008. At the present time, approximately 13,891 people are employed by the oil and gas cluster.⁵⁴

The latest statewide employment report published by the Louisiana Department of Labor stated that 500 jobs in the oil and gas extraction industry had been lost over the previous eight months (March 2002-December 2002). Most of the job losses in this cluster are attributed to the extraction segment, and it is due to a variety of factors, among them are new wildcat wells drilled, depleting reserves, decreasing prices and environmental considerations such as the denying of permits for oil and gas drilling in environmentally sensitive areas.

Drilling is the primary factor that influences employment in the exploration and production segment of the oil and gas industry. The rig count is one of the primary measures of the health of the exploration segment of the oil and gas industry. In a very real sense it is a measure of the oil and gas industry's confidence in its own future. From October 2001 through October 2002, the United States rig count declined by 23 percent, from 1,111 active rigs to 852 active rigs.⁵⁵ The following table outlines the decline in the rig count for south Louisiana (this table includes southwestern Louisiana, which is not the in Greater New Orleans region) that have been compiled by Baker Hughes Inc.⁵⁶ Specific rig counts for the Greater New Orleans region were not available.

⁵⁴ Louisiana Department of Labor

⁵⁵ Source: Baker Hughes Inc.

⁵⁶ In 1907, Reuben C. Baker developed a casing shoe that revolutionized cable tool drilling. In 1909, Howard R. Hughes, Sr. introduced the first roller cutter bit which dramatically improved the rotary drilling process. Over the next eight decades, Baker International and Hughes Tool Company became worldwide leaders in well completions, drilling tools and related services. The two companies merged in 1987 to form Baker Hughes Incorporated. The company is publicly traded under the symbol BHI, and generated revenues of \$5.4 billion in 2001.

	November of 2002					
	NOV 1	NOV 8	NOV 15	NOV 22	NOV 27	NOV AVG
S LOUISIANA-INL WATER	18	18	18	16	15	17
S LOUISIANA-LAND	35	35	33	27	33	33
S LOUISIANA-OFFSHORE	89	88	86	85	89	87
TOTAL LOUISIANA	142	141	137	128	137	137

	November of 2001					
	NOV 2	NOV 9	NOV 16	NOV 21	NOV 30	NOV AVG
S LOUISIANA-INL WATER	17	17	18	19	18	18
S LOUISIANA-LAND	40	39	33	33	33	36
S LOUISIANA-OFFSHORE	106	104	105	105	106	105
TOTAL LOUISIANA	163	160	183	157	157	185

Source: Baker Hughes Incorporated

One of the factors cited for the decline in employment in the oil and gas industry was a decline in wildcat drilling. This segment of oil and gas extraction is rarely practiced at present and has substantially declined over the last twenty years. The American Petroleum Institute reported 9,151 newly-filed wildcat wells drilled in the United States in 1981; by 2001 that number had decreased to 1,166. The Louisiana employment in this segment reflects this downwards trend, having also substantially declined over the same time period. The Louisiana Department of Labor reports that statewide employment in the exploration and production segment of the oil and gas industry peaked at 94,772 in 1981 and by 2001 employment had decreased to 47,009.

Retirement Driven Employment Changes

The Society for Petroleum Engineers estimates that by 2010 the oil and gas industry is likely to lose more than 60 percent of all employees due to retirement-driven attrition. A U.S. Department of Labor Department study found that more than 65 percent of workers in the oil and gas industry are between the ages of 35 and 54. A recent survey found that 70 percent of the members of the Houston Geological Society are age 40 or older. If we assume that 40 percent of the current employees in the regional oil and gas cluster will retire by 2008, companies that comprise the regional oil and gas cluster will have to hire 2,226 additional people over this time frame to meet the 2008 projected employment level of 10,561.

Conclusion (Regional):

Although total employment is projected to decrease in the oil and gas cluster, we estimate that 2,226 new hires will be made as a result of the high number of workers that are expected to retire between now and 2008. The U.S. Department of Labor Statistics breaks down the employment in the oil and gas industry into seven occupational segments with the employment broken down as follows:

Occupation Segment	Percentage Employed	Projected Hires
Financial and Business Management	12.6%	280
Professional and Related Occupations	11.3%	252
Office and Administrative Support	13.0%	289
Construction and Extraction Occupations	36.0%	801
Installation Maintenance and Repair	6.0%	134
Production Occupations	8.9%	198
Transportation and Material Moving Occupations	12.2%	272
	100.0%	2226

Source: U.S. Department of Labor

As technology continues to shift the needs of all industries from unskilled labor to skilled trades and professions, so the oil and gas industry follows suit. Although exploration and production may continue to grow or contract, depending on energy prices, technology advances resulting in increased productivity will keep labor growth rates low with the exception of computer and service unit operators.

Tourism and Entertainment

(please note: Tourism is not included in the overall cluster analysis)

Eating and drinking establishments provide many young people with their first jobs—in 2000, 25 percent of all workers in these establishments were aged 16 to 19, over 5 times the average for all other industries.⁵⁷ Cooks, waitstaff and other food preparation and serving workers held almost 9 out of 10 jobs in this industry.⁵⁸ Thirty-eight percent of all employees work part time; more than double the average for all industries as a whole. Job opportunities will be plentiful due to high turnover; there are few or no formal education or training requirements and earnings tend to be relatively low.⁵⁹

So fundamental are the services provided by eating and drinking establishments, that this may be the world’s most widespread and familiar industry. In the United States, the eating and drinking establishments industry comprises about 458,000 places of employment⁶⁰ located throughout large cities, small towns and rural areas. These establishments include all types of restaurants, from fast food to elegant and expensive. They also include drinking establishments which primarily sell alcoholic beverages for consumption on the premises.

Restaurants make up the majority of establishments in this industry. The most common type is a franchised operation of a nationwide restaurant chain that sells fast food. According to the National Restaurant Association, fast-food restaurants accounted for

⁵⁷ Source: U.S. Bureau of Labor Statistics

⁵⁸ Source: U.S. Bureau of Labor Statistics

⁵⁹ Source: U.S. Bureau of Labor Statistics

⁶⁰ Source: U.S. Bureau of Labor Statistics

one out of every three eating and drinking establishments in 2000; the number of these establishments has increased steadily from 20 percent of the industry in 1970. A limited menu, lack of waitstaff and emphasis on self-service characterizes these restaurants. Menu selections are usually prepared by workers with limited cooking skills. Because the food is typically served in disposable, take-out containers that retain the food's warmth, it often is prepared prior to a customer's request. A growing number of fast-food restaurants are providing drive-through and delivery services.

The eating and drinking establishments industry, with about 8.1 million salaried jobs in 2000, ranks among the nation's leading employers.⁶¹ Eating and drinking establishments tend to be small; about 54 percent of the establishments in the industry employ fewer than 10 paid workers.⁶² As a result, this industry is often considered attractive to individuals who want to own and run their own businesses. An estimated 233,000 self-employed business owners work in this industry, representing about 3 percent of total employment.⁶³

This industry and particularly the fast-food establishments within it, is a leading employer of teenagers - aged 16 - 19 - providing first jobs for many new entrants to the labor force.⁶⁴ In 2000, nearly 25 percent of all workers in eating and drinking establishments were teenagers (please refer to the table on p. 49 and roughly 45 percent were under age 25, triple the proportion in all other industries.

Key Occupations

Food Service Managers, Lodging Managers, Food Preparation Workers, Wait Staff, Food Service, Porters.

Wages (Regional)

Several key occupations have wages which are less than both national and southern averages. Houston is the exception, with average earnings below New Orleans. The disparity in wages is greater against national averages than southern averages.

Training Sources Used

With the exception of a few culinary programs and institutes, notably at Delgado Community College and the University of New Orleans, most of the food service workers are trained on the job.

⁶¹ Source: U.S. Bureau of Labor Statistics

⁶² Source: U.S. Bureau of Labor Statistics

⁶³ Source: U.S. Bureau of Labor Statistics

⁶⁴ Source: U.S. Bureau of Labor Statistics

Employment Changes (National)

Job opportunities in eating and drinking establishments should be plentiful. Salaried jobs in eating and drinking establishments are expected to increase by 18 percent from year 2000-2010, slightly faster than the 16 percent growth projected for all industries combined.⁶⁵ In addition to employment growth, vast numbers of job openings will be created by turnover-driven replacement needs in this large industry as experienced workers find other jobs or stop working. The high job turnover reflects the large number of young, part-time workers in this industry. Thus, numerous jobs will be available for people with limited job skills, first-time job seekers, senior citizens and those seeking part-time work.

Increases in population, personal incomes, leisure time and dual-income families will contribute to job growth. With a growing proportion of the national population concentrated in older age groups, moderately-priced restaurants that offer table service and that appeal to families should be the fastest growing segment of the eating and drinking establishments industry. Fine dining establishments, which appeal to affluent, often older, customers, should also grow as the 45-and-older segment of the population increases rapidly. Conversely, the numbers of limited-service and fast-food restaurants that appeal to younger diners should increase more slowly than in the past. As schools, hospitals and company cafeterias contract out institutional food services, jobs should shift to firms specializing in these services. Also, an aging population should drive up the demand for managerial and food service workers in nursing homes and assisted-living facilities through the year 2010.

⁶⁵ U.S. Bureau of Labor Statistics

Employment of wage and salary workers in eating and drinking places by occupation, 2000 and projected change, 2000-10. (Employment in Thousands)			
Occupation	Employment, 2000		Percent change, 2000-10
	Number	Percent	
All occupations	8,114	100	18.3
Management, business, and financial occupations	387	4.8	16.8
Food service managers	237	2.9	24.7
General and operations managers	104	1.3	3.6
Service occupations	7,178	88.5	19.3
Chefs and head cooks	100	1.2	17
First-line supervisors/managers of food preparation and serving workers	414	5.1	9.6
Cooks, fast food	493	6.1	-1.3
Cooks, restaurant	560	6.9	26.9
Cooks, short order	140	1.7	-0.9
Food preparation workers	356	4.4	14.5
Bartenders	253	3.1	9.6
Combined food preparation and serving workers, including fast food	1,793	22.1	38.4
Counter attendants, cafeteria, food concession, and coffee shop	217	2.7	9.6
Food servers, nonrestaurant	62	0.8	9.6
Waiters and waitresses	1,664	20.5	24.8
Dining room and cafeteria attendants and bartender helpers	273	3.4	-12.3
Dishwashers	372	4.6	-12.3
Hosts and hostesses, restaurant, lounge, and coffee shop	277	3.4	18.7
Building cleaning workers	66	0.8	9.6
Sales and related occupations	234	2.9	9.6
Cashiers, except gaming	209	2.6	9.6
Office and administrative support occupations	87	1.1	0.4
Transportation and material moving occupations	166	2	6.5
Driver/sales workers	118	1.4	9.6
NOTE: May not add to totals due to omission of occupations with small employment.			

Employment Changes (Regional)

Employment growth in this cluster is expected to be moderate. The following table identifies the growth in employment in key occupations of the cluster.

Waitstaff +2.4%
Fast Food Cooks +3.0%
Managers +2.6%
Hosts/Hostesses +2.8%

This cluster has a location quotient of 1.16, which indicates that tourism still drives the food and beverage segment of this cluster. The Louisiana Department of Labor states

that hospitality sector employment in the Greater New Orleans region will grow 27 percent from 1998 through 2008 and create an additional 12,760 jobs during this time frame.

Retirement Driven Employment Changes

Because of the high turnover in this cluster which creates constant demand for new workers, retiring workers will not greatly impact the projected levels of hiring.

Conclusion

Wages will continue to be low, and job growth will remain high, but advancement options in these careers are limited. There is a need to add additional value. Overall industry growth will be moderate as a result of uncertainty over the future of tourism growth which has been affected by events related to the September 11, 2001 terrorist bombings and could be increasingly affected by the growing conflict in the Middle East.

Maritime Cluster

According to the U.S. Bureau of Labor Statistics, water transportation workers held about 70,000 jobs in 2000. The total number who worked at some point in the year was somewhat higher because many merchant marine officers and seamen worked only part of the year. The following tabulation, based on data from the U.S. Bureau of Labor Statistics and the Louisiana Department of Labor, shows employment in the occupations that make up this group:

Sailors and marine oilers	32,000
Ship and boat captains and operators	25,000
Ship engineers	8,600
All other water transportation workers	4,900

More than 75 percent of these workers were employed in water transportation services. Of these, about 39 percent worked in establishments related to marine cargo handling, towing and tugboat services, marinas or boat cleaning and marine salvaging. About 25 percent worked in the transportation of freight on the oceans or the Great Lakes, while about 13 percent were employed in the water transportation of passengers on the deep seas, ferries or sightseeing boats. The Federal government employs approximately 10 percent of all water transportation workers.⁶⁶

⁶⁶ Source: U.S. Bureau of Labor Statistics

Key Occupations

Key occupations within this industry cluster in the Greater New Orleans region are: Vessel Captains, Seamen, Shipping Clerks, Ship Mates, Transport Supervisors, Cleaners, and Mechanics.

Wages (Regional)

Earnings fall below average in 4 of 5 southern cities where the Maritime Industry has a substantial presence (Miami, Fla. is the exception). Compared to two top competitors, the average earnings are lower by 10 percent (Mobile, Ala.) and 24 percent (Houston, Tx.).

Training Sources Used

In-house on-the-job training is often utilized. Both the local Louisiana Technical Colleges and Delgado Community College provide specific skills training. Industry associations also provide specific skills training.

Employment Changes (National)

Keen competition is expected to continue for jobs in water transportation occupations. Overall, employment in water transportation occupations is projected to increase 3 - 9 percent for all occupations through the year 2010.⁶⁷ Opportunities will vary by sector. Employment in deep-sea shipping for American mariners is expected to stabilize after several years of decline. New international regulations have raised shipping standards with respect to safety, training, and working conditions. Consequently, competition from ships that sail under foreign *flags of convenience* (FOCs) should lessen as insurance rates rise for ships that do not meet the new standards. Insuring ships under industrialized countries' flags, including that of the United States, should become less expensive, increasing the amount of international cargo carried by U.S. ships. A fleet of deep-sea U.S. flagged ships is considered to be vital to the Nation's defense, so some of these ships receive Federal support through a maritime security subsidy and other provisions in laws which limit certain Federal cargoes to ships that fly the U.S. flag.

Newer ships are designed to be safely operated by much smaller crews. Innovations include automated controls and computerized monitoring systems in navigation, engine control, watch keeping, ship management, and cargo handling. As older vessels are replaced, computer skills will become more important for crews. Possible future developments include *fast ships*, ocean-going cargo vessels that use jet propulsion, which would decrease ocean-crossing times significantly. If such plans are successful, the industry will benefit in terms of increased business and employment.

Vessels on rivers and canals and on the Great Lakes carry mostly bulk products such as coal, iron ore, petroleum, sand and gravel, grain and chemicals. Though shipments of

⁶⁷ Source: U.S. Bureau of Labor Statistics

these products are expected to grow through the year 2010, current steel imports are dampening employment on the Lakes. Employment in water transportation services is likely to rise, however.

Employment Changes (Regional)

Employment growth in the Greater New Orleans region is expected to be low-to-moderate. The following table identifies the growth in employment in key cluster occupations.

Captains +.5%
Seamen +1 %,
Clerks +.6%
Mates +.9%
Supervisors +1.9%
Cleaners +3.6%
Mechanics +2.8%

According to the Louisiana Department of Labor, 12,530 people are employed in the water transportation segment of the cluster and no growth is predicted to occur from 1998 through 2008. Another 12,200 people are employed in the precision manufacturing of transportation equipment in the Greater New Orleans region, primarily composed of the shipbuilding industry included in the Maritime Cluster in this report. The Louisiana Department of Labor predicts an 8 percent drop in employment in the shipbuilding segment of the maritime cluster from 1998 through 2008.

Conclusion

Regional growth is forecasted to be low-to-moderate; however recent activities of the Maritime cluster could provide new opportunities for growth. In mid-September 2002, the five ports along the lower Mississippi River corridor announced a cooperative agreement to gather and share data on trends affecting the development of the maritime trade in southeast Louisiana and to collaboratively market the services of the ports. These are the central elements of an aggressive new plan to grow economic development opportunities associated with Louisiana's historically strong ports. The program will be administered by the University of New Orleans and will involve the Port of Greater Baton Rouge, the Port of New Orleans, the Port of St. Bernard, the Port of Plaquemines and the Port of South Louisiana. The program was convened under the umbrella of the MetroVision Maritime Cluster Committee, co-chaired by Walter Boasso, president of Boasso America Corp., an intermodal shipping company, and Erik L. Johnsen, executive vice president of International Shipholding Corp., a New Orleans-based steamship company.

Collectively, these five ports represent the largest U.S. port system in terms of tonnage. The cooperative endeavor agreement is intended to help the ports join forces to maximize

growing opportunities in international trade and also to better coordinate opportunities for waterborne shipments to and from the U.S. heartland. In addition, the ports would like to develop increased business activity and jobs in their communities related to port activity. Data gathered from the five ports will be coordinated for strategic marketing use by UNO's College of Urban and Public Affairs.

These actions have the potential to greatly increase the ability of maritime firms in the region to compete with Houston, Tx. and Mobile, Ala., resulting in more employment opportunities. According to Eric Johnsen and Walter Boasso, the industry has lost several thousand jobs over the past 15 years due to lack of cooperation between the ports in addressing issues such as fees and channel pilot charges.

Additional jobs will be created by the retirement of approximately 6,000 number current workers over the next five years which will create replacement demand.

Petrochemical Cluster

Chemicals generally are classified into two groups—commodity chemicals and specialty chemicals. Commodity chemical manufacturers produce large quantities of basic and relatively inexpensive compounds in large plants, often built specifically to make one chemical. Most of these basic chemicals are used by companies operating in other industries to make more highly refined chemicals used in the production of everyday consumer goods. Specialty chemical manufacturers, on the other hand, produce smaller quantities of more expensive chemicals that are used less frequently. Specialty chemical manufacturers often supply larger chemical companies on a contractual basis. Many traditional commodity chemical manufacturers are divided into two separate entities, one focused on commodities and the other on specialty chemicals.

Chemicals are an essential component of manufacturing, vital to industries such as construction, motor vehicles, paper, electronics, transportation, agriculture and pharmaceuticals. Although some chemical manufacturers produce and sell consumer products such as soap, bleach and cosmetics, most chemical products are used as intermediate products for other goods.

Chemical manufacturing is divided into eight segments, seven of which are covered here: Plastics materials and synthetics; cleaning preparations; organic chemicals; inorganic chemicals; miscellaneous chemicals; paints and allied chemical products and agricultural chemicals. The eighth segment, drug manufacturing, is covered in a separate *Career Guide* in the attached Appendix I.

The largest employer of the segments included here is the plastics materials and synthetics industry, which produces a wide variety of finished products as well as raw materials. Some of these include polyethylene, polypropylene, polyvinyl chloride (PVC), and polystyrene, which can be made into products such as loudspeakers, toys, PVC pipes,

and beverage bottles. Motor vehicle manufacturers are particularly large users of these products.⁶⁸

According to the U.S. Bureau of Labor Statistics, the chemical and allied products industry employed about 723,000 salaried workers in 2000, about 4 percent of the total number employed in manufacturing and almost 10 percent of the total number employed in nondurable goods manufacturing. Most segments of the industry had substantial numbers of jobs, as illustrated in the following table.

Distribution of wage and salary employment in chemicals		
Industry	Employment	Percent
Total, all industries	723,000	100
Soap, cleaners, and toilet goods	155,000	14.9
Plastics materials and synthetics	154,000	14.8
Industrial organic chemicals	120,000	11.5
Industrial inorganic chemicals	98,000	9.4
Miscellaneous chemical products	93,000	9
Paints and allied products	52,000	5
Agricultural chemicals	51,000	4.9

Nearly three-fifths of those employed in the industry work in production; installation, maintenance and repair; and transportation and material-moving occupations. More than one-fifth work in management, business, and financial and office and administrative support occupations. About 14 percent work in professional and related occupations.⁶⁹

Key Occupations

The key occupations within this industry cluster in the Greater New Orleans region are: Equipment Operators, Maintenance Workers, Machinery Mechanics Supervisors, and Engineers.

Wages (Regional)

The overall average hourly earnings are the highest of all clusters (\$22.80). The average wages are lower than Houston's, as the greater concentration of management, professional and technical occupations in Houston accounts for a higher wage structure. Earnings of mid-range occupations in New Orleans exceeded earnings in both Houston and Dallas, due to scarcity in the local labor market. Compared to the south and the nation, the wages are generally higher in this cluster.

⁶⁸ Source: U.S. Bureau of Labor Statistics

⁶⁹ Source: U.S. Bureau of Labor Statistics

Training Sources Used

The operator position typically requires a two-year degree in Petroleum Technology (p-tech), which is offered statewide by Baton Rouge Community College, LCTCS-Reserve, McNeese State, Lake Charles LCTCS, and also by the College of the Mainland in Houston, Texas.

Glass Labs also provide hands on & book-learning experience that students need. Glass Labs provide a hands-on curriculum for the students in Process Technology (PTEC). The PTEC associate degree was developed in collaboration with the Louisiana Petrochemical industry. There are currently three of these labs in the State, located at the Louisiana Technical College campuses in Baton, Reserve and Lake Charles.

Electrical technicians obtain skills and knowledge through contracting, and usually some ABC training as a contractor.

Employment Changes (National)

Although the chemical industry's output is expected to grow, employment in the chemical and allied products industry, excluding drug production, is projected to decline by about 4 percent over the period between 2000 and 2010, compared with 15 percent growth expected for the entire economy. The expected decline in chemical manufacturing employment can be attributed to trends affecting the U.S. and global economies. There are several factors that will influence chemical industry employment, such as more efficient production processes and increased plant automation, the state of the national and world economy, company mergers and consolidation, increased foreign competition, outsourcing of production, growth of environmental health and safety concerns and legislation, precision farming techniques and an emphasis on specialty chemicals.

Improvements in production technology have reduced the need for workers in production; installation, maintenance, and repair; and material-moving occupations, which account for a large proportion of jobs in the chemical industry. The growing application of computerized controls in standard production, and the growing manufacture of specialty chemicals requiring precise, computer-controlled production methods, will reduce the need for workers to monitor or directly operate equipment. Although production facilities will be easier to run with the increased use of computers, the new production methods will require workers with a better understanding of the use of the systems.

Foreign competition has been intensifying in most industries, and the chemical industry is no exception. Although the U.S. chemical industry has enjoyed a favorable trade balance for quite some time, growing global trade and rapidly expanding foreign production capabilities should increase competition. Pressure to reduce costs and streamline production will result in the continuing mergers and consolidation of companies both within the United States and abroad. Mergers and consolidations are allowing chemical companies to increase profits by eliminating duplicate departments and shifting

operations to locations in which operating costs are lowest. U.S. companies are expected to move some production activities to developing countries—those in East Asia and Latin America, for example—to take advantage of rapidly expanding markets.

To satisfy growing public environmental concerns and to comply with the many government regulations, the chemical industry annually invests billions of dollars in technology to reduce pollution and clean up existing waste sites. Growing concerns about chemicals and the environment will spur producers to create chemicals with fewer and less dangerous by-products that can be recycled or disposed of in a cleaner, more efficient manner. This will require greater investment in research and development. As a result, occupations related to environmental compliance, improved product visibility and promotion of consumer confidence should grow.

Precision farming techniques have reduced the demand for agricultural chemicals in this country as farmers use computer technology to determine which chemicals need to be applied to different areas of a farm, rather than simply fertilizing the whole farm. However, this reduced demand will be partially offset by the increase in global demand for agricultural chemicals as other countries become more sophisticated in their farming techniques.

Another trend in the chemical industry is the rising demand for specialty chemicals. Chemical companies are finding that, in order to remain competitive, they must differentiate their products and produce specialty chemicals, such as advanced polymers and plastics designed for customer-specific uses—for example, a durable body panel on an automobile. Because advanced processes are often needed to produce specialty chemicals, this trend should increase employment opportunities for highly trained research and development and production-oriented chemists, chemical engineers, technicians, and production personnel. In small to medium-size firms, responsiveness to customers' chemical needs is imperative, so opportunities for marketing staff such as sales engineers also should be available. An emerging technology within specialty chemicals that will require more research and development is the modeling of chemical reactors and batch and continuous processes.

The factors affecting employment in the chemical manufacturing industry will impact different segments of the industry to varying degrees. The two segments projected to add the most jobs are agricultural chemicals, with an increase of about 4,500 jobs; and paints and allied products, with an increase of around 4,000 jobs. The two areas which will lose the most jobs are plastics materials and synthetics with approximately 24,000 fewer jobs projected, and industrial inorganic chemicals with a projected loss of approximately 16,000 jobs.⁷⁰

⁷⁰ Source: U.S. Bureau of Labor Statistics

Employment of wage and salary workers in chemicals manufacturing, except drugs, by occupation, 2000 and projected change, 2000-10 (Employment in

Occupation	Employment, 2000		Percent change,
	Number	Percent	
All occupations	723	100	-4.5
Management, business, and financial	77	10.6	-3.3
Marketing and sales managers	7	1	12.3
General and operations managers	12	1.7	-3.6
Industrial production managers	10	1.3	-7.4
Business operations specialists	14	2	-4.2
Professional and related	99	13.7	-6.1
Computer specialists	9	1.2	19.3
Chemical engineers	12	1.6	-11.1
Chemists	16	2.2	-3.7
Chemical technicians	23	3.1	-7.3
Sales and related	24	3.3	-3.7
Sales representatives, wholesale and manufacturing, technical and scientific products	8	1.2	-5.2
Sales representatives, wholesale and manufacturing, except technical and scientific products	9	1.3	-4
Office and administrative support	84	11.7	-6.3
Bookkeeping, accounting, and auditing clerks	7	1	-10.5
Customer service representatives	9	1.3	2
Shipping, receiving, and traffic clerks	12	1.7	-4.1
Executive secretaries and administrative assistants	9	1.2	-10.7
Installation, maintenance, and repair	56	7.8	-8.2
Industrial machinery mechanics	13	1.8	-4.3
Maintenance and repair workers, general	20	2.8	-12.9
Production	300	41.6	-3.8
First-line supervisors/managers of production and operating workers	28	3.8	-10.5
Team assemblers	14	1.9	-2.4
Metal workers and plastic workers	15	2.1	-11.5
Chemical plant and system operators	56	7.8	-6
Extruding and forming machine setters, operators, and tenders, synthetic and glass fibers	15	2.1	-12.7
Textile winding, twisting, and drawing out machine setters, operators, and tenders	9	1.2	-13.1
Chemical equipment operators and tenders	33	4.6	4.9
Mixing and blending machine setters, operators, and tenders	29	4.1	5.4
Helpers--Production workers	17	2.4	-4.1
Inspectors, testers, sorters, samplers, and weighers	12	1.6	-19.3
Packaging and filling machine operators and tenders	28	3.9	8.2
Transportation and material moving	65	8.9	-2
Truck drivers, heavy and tractor-trailer	10	1.4	-3.5
Industrial truck and tractor operators	10	1.4	-2.7
Laborers and freight, stock, and material movers, hand	14	1.9	-6.7
Packers and packagers, hand	12	1.6	6.6

NOTE: May not add to totals due to omission of occupations with small employment.

Source: U.S. Bureau of Labor Statistics

Employment Changes (Regional)

According to the Louisiana Department of Labor, 13,240 people are employed in the Petrochemical Cluster in the Greater New Orleans region. The employment and the projected growth rates are broken down as follows:

<u>INDUSTRY TITLE</u>	<u>1998</u>	<u>2008</u>	<u>CHANGE</u>	
	<u>ANNUAL</u>	<u>PROJECTED</u>	<u>IN</u>	<u>PERCENT</u>
	<u>AVERAGE</u>	<u>EMPLOYMENT</u>	<u>EMPLOYMENT</u>	<u>CHANGE</u>
	<u>EMPLOYMENT</u>	<u>EMPLOYMENT</u>	<u>1998-2008</u>	<u>1998-2008</u>
Chemicals & Allied Products	7,970	9,080	1,110	13.60
Petroleum and Coal Products	3,920	4,120	200	5.08
Rubber & Misc. Plastics Products	1,350	1,720	370	27.66

Source: Louisiana Department of Labor

Employment growth in this cluster should register strong to moderate increases over the next several years. This trend is in reverse of the national trend that projects a decline in employment in this industry primarily as a result of the specialty chemical manufacturers that are present in the cluster.

Retirement Driven Employment Changes

Accenture⁷¹ recently completed a study on high-end knowledge workers that examined what problems global petrochemical companies will face as a result of changing workforce demographics. The study found that the vast majority of petrochemical companies are concerned about their aging workforce. Accenture's study estimates that 50 percent of employees in the petrochemical industry will reach retirement age during the next decade.

Conclusion

A combination of continued demand for new products and a rapidly aging workforce, particularly in skilled trades, will create relatively high growth in demand. The typical operator position requires 3-5 years of training and getting qualified entrants onto the career track for this industry will be critical over the next five years.

⁷¹ Accenture is widely recognized as one of the world's leading management and technology services organizations. Accenture was formerly an affiliate of Andersen Consulting, but was spun off from the accounting firm in 1997. Accenture employs 75,000 people in 47 countries. More information on Accenture can be found at www.accenture.com.

Shipbuilding and Precision Manufacturing

(Not Included in Overall Cluster Analysis)

Key Occupations

Welders, Machinists, Sheet Metal Workers, Millwrights, Maintenance Workers, Supervisors, Helpers.

Wages

Southeastern Louisiana's wages for this industry are generally lower than national wages and higher than the southern average except that of Houston, which has the highest concentration of any cluster in region. The highly skilled fabrication and professional occupations command higher wages than average due to the scarcity of qualified employees to fill these positions. Structural metal precision fitters, electricians and industrial engineering technicians are also in this skilled group.

Training Sources Used.

Vestibule training is used for blueprint reading and shop math. Technical and community colleges are also used as a source of training, but many companies have stated that these institutions need to return to an emphasis on technical skills, not traditional four-year college learning. According to industry, process training and certifications offered by technical schools need more emphasis.

Employment Growth (Regional)

Growth rates are projected to be moderate to relatively high. The highest rates of growth will be for the following occupations:

Welders +1.9 %
Machinists +2.3 %,
Sheet metal workers +3.2 %
Millwrights +2.6 %
Maintenance +2.7 %
Helpers +2.7 %.

Conclusion

Steady growth should persist continue as a result of continued demand for vessels for both defense and oil/gas exploration. As oil/gas exploration moves farther offshore, both the number and size of vessels required will increase. Although technology will eliminate low-skilled positions, the demand forecast will require more skilled trades such as pipefitters, welders, shipfitters, dry dock operators, scaffolders and machinists.

Warehousing/Distribution

(Not Included in Overall Cluster Analysis)

According to the U.S. Bureau of Labor Statistics, the trucking and warehousing industry provided more than 1.8 million salaried jobs in 2000. Approximately half of the salaried jobs in the industry, 926,000, consisted of truckdrivers and driver/sales workers. Other transportation and material-moving jobs numbered 350,000 and another 314,000 jobs were in various office and administrative support occupations. There were about 99,000 managers; 57,000 bus and truck mechanics and diesel engine specialists; and 31,000 sales and related workers. In addition to salaried workers, an estimated 289,000 workers in the industry were self-employed in 2000.

Most employees in the trucking and warehousing industry work in small establishments. Over 3 out of 4 trucking and warehousing establishments employ fewer than 10 workers. Industry consolidation has reduced the number of small, specialized firms. About 8 percent of truckdrivers operate their own business. Although more owner-operators enter the industry each year, intense competition has caused many to fail.⁷²

Trucking and warehousing establishments are found throughout the United States, with a higher concentration around the major interstate highways and in heavily industrialized regions of the country such as in California, New Jersey and Texas.

Firms in the distribution and warehousing industry provide a link between manufacturers and consumers. Businesses, and occasionally individuals, contract with trucking and warehousing companies to pick up, transport, store and deliver a variety of goods. This industry includes two segments, *local and long-distance trucking and terminals* and *public warehousing and storage*. However, the trend towards full-service logistical companies is blurring the distinction between trucking and warehousing.

Local and long-distance trucking and terminals provide over-the-road cargo transportation using motor vehicles, such as trucks and tractor-trailers. This industry segment is further subdivided based on the distance traveled and the type of goods delivered. Local trucking establishments primarily carry goods within a single metropolitan area and its adjacent non-urban areas. Long-distance trucking establishments carry goods between distant areas. Courier service establishments handle individual letters and light packages.

Local trucking comprised almost 65,000 trucking establishments in 2000.⁷³ The work of local trucking firms varies depending on the products transported. Produce truckers usually pick up loaded trucks early in the morning and spend the rest of the day delivering produce to many different grocery stores. Lumber truckdrivers, on the other hand, make several trips from the lumber yard to one or more construction sites. Some local truck transportation firms also take on sales and customer relations responsibilities,

⁷² U.S. Bureau of Labor Statistics

⁷³ U.S. Bureau of Labor Statistics

in addition to delivering the firm's products. Some local trucking firms specialize in local furniture moving, garbage collection and trash removal or hauling dirt and debris.

Long-distance trucking firms account for a majority of the jobs in the trucking and warehousing industry. Numbering more than 51,000 establishments,⁷⁴ this sector is comprised of establishments primarily engaged in providing long-distance trucking between distant areas and sometimes between the United States and Canada and Mexico. These establishments handle a wide variety of commodities, transported in numerous types of equipment—from refrigerated trailers to flatbeds. Included in this industry are establishments operating as truckload (TL) or less than truckload (LTL) carriers.

Motor freight transportation terminals are mostly operated by large trucking companies. However, there were about 473 independent terminals not affiliated with trucklines in 2000.⁷⁵ Many of these independent terminals break down truckloads of produce and other foods into shipments to area wholesalers. Many terminals also offer truck maintenance and repair services.

Public warehousing and storage facilities comprised more than 15,000 establishments in 2000.⁷⁶ These firms were primarily engaged in operating warehousing and storage facilities for general merchandise and refrigerated goods. They provided facilities to store goods; self-storage mini-warehouses that rent to the general public are also included in this segment of the industry.

The deregulation of interstate trucking in 1980 encouraged many firms to add a wide range of customer-oriented services to complement trucking and warehousing services which in turn led to innovations in the distribution process. Increasingly, trucking and warehousing firms provide businesses with full-service logistical services encompassing the entire transportation process, including inventory management, materials handling and warehousing. Firms that offer these services are often referred to as third-party logistics providers. Logistical services manage all aspects of the movement of goods between producers and consumers, such as sorting bulk goods into customized lots, packaging and repackaging goods, inventory control and management, order entry and fulfillment, labeling, light assembly, and price marking. Logistical services such as computerized inventory information on the location, age, and quantity of goods available have improved the efficiency of relationships between manufacturers and customers. Just-in-time shipping—where trucking companies deliver goods from suppliers just in time for their use—allows recipients to reduce costly inventories but requires constant communication and accurate inventory information. Packaging, labeling, and small assembly of manufacturers' products are other services that warehousing establishments use to attract potential customers. Some full-service companies even perform warranty repair work and serve as local parts distributors for manufacturers.

⁷⁴ U.S. Bureau of Labor Statistics

⁷⁵ U.S. Bureau of Labor Statistics

⁷⁶ U.S. Bureau of Labor Statistics

Key Occupations

The key occupations within this industry cluster in the Greater New Orleans region are: Truck Drivers, Packers and Packagers, Engine Mechanics, Communication Managers, Dispatchers.

Wages (Regional)

The average is slightly less than other southern areas, and moderately lower than national averages. The wages are considerably lower than Memphis, Dallas, Atlanta, and Jackson.

Training Resources Used

A variety of private truck driving schools that qualify for student financial aid are utilized for entry-level training.

Employment Changes (National)

The number of salaried jobs in the trucking and warehousing industry is expected to grow 22 percent from 2000 through 2010, compared with projected growth of 16 percent for all industries combined.⁷⁷ Because the industry is large and tends to be somewhat transient, many job openings will result—not only from employment growth—but also from the need to replace the large number of workers who transfer to other industries or retire. Opportunities in this industry should be good for qualified workers at all levels, especially in truck driving and service technician occupations.

One of the main factors influencing the growth of the trucking and warehousing industry is the state of the national economy. Growth in this industry parallels economic upswings and downturns. As the national economy grows, production and sales of goods increase, thus increasing demand for transportation services to move goods from producers to consumers. In a recession, this industry is one of the first to slow down as orders for goods and shipments decline. Competition in the trucking and warehousing industry is intense, both amongst trucking companies and, in some long-haul truckload segments, with the railroad industry. Nevertheless, trucking has increasingly accounted for larger shares of freight transportation revenue.

Additional employment growth will result from manufacturers' willingness to concentrate more on their core competencies—producing goods—and outsource their distribution functions to trucking and warehousing companies. As firms in other industries increasingly employ this industry's logistical services, such as inventory management and just-in-time shipping, many new jobs will be created. Also, the expansion of electronic commerce as more consumers and businesses make purchases over the Internet will continue to increase the demand for transportation and logistical services provided by the trucking and warehousing industry.

⁷⁷ U.S. Bureau of Labor Statistics

Opportunities for qualified truckdrivers are expected to be favorable. In some areas, companies have experienced difficulties recruiting adequately skilled drivers. Truck driving pays relatively well, according to the latest data from the U.S. Bureau of Labor Statistics that was compiled from September of 2001 through October of 2002, the mean wage for truck drivers in the New Orleans MSA was \$12.90 per hour. However, many workers leave the career because of the lengthy periods away from home, long hours of driving and the negative public image drivers face. Stricter requirements for obtaining—and keeping—a commercial driver’s license also makes truck driving less attractive as a career. Opportunities for diesel service technicians and mechanics are also expected to be favorable, especially for applicants with formal postsecondary training.

Growth in the trucking and warehousing industry should prompt an increase in office and administrative support employment. More dispatchers, stock clerks, and shipping, receiving and traffic clerks will be needed to support expanded logistical services across the country. However, fewer secretaries, bookkeepers, and file clerks will be needed because computers and other automated equipment will make workers in these occupations more efficient and productive.

Courier and delivery services have been one of the most rapidly growing segments of the industry. Employment is expected to continue to increase even as competition from overnight air-courier firms and business use of fax machines and e-mail moderates growth.

Employment of wage and salary workers in trucking and warehousing by occupation, 2000 and projected change, 2000-10 (Employment in thousands)			
Occupation	Employment, 2000		Percent change, 2000-10
	Number	Percent	
All occupations	1,856	100	21.9
Management, business, and financial occupations	99	5.3	31.4
General and operations managers	38	2	24.7
Transportation, storage, and distribution managers	18	1	46.2
Sales and related occupations	31	1.7	29.8
Office and administrative support occupations	314	16.9	17.1
First-line supervisors/managers of office and administrative support workers	21	1.1	33.2
Billing and posting clerks and machine operators	19	1	3.1
Bookkeeping, accounting, and auditing clerks	21	1.2	12.3
Customer service representatives	22	1.2	38.1
Couriers and Messengers	41	2.2	-6
Dispatchers, except police, fire, and ambulance	40	2.1	24.3
Shipping, receiving, and traffic clerks	19	1	35
Office clerks, general	46	2.5	16.4
Installation, maintenance, and repair occupations	96	5.2	12.4
Bus and truck mechanics and diesel engine specialists	57	3	1.7
Maintenance and repair workers, general	15	0.8	24
Transportation and material moving occupations	1,276	68.7	22.5
First-line supervisors/managers of helpers, laborers, and material movers, hand	16	0.9	23.3
First-line supervisors/managers of transportation and material-moving machine and vehicle operators	32	1.7	24.4
Truck drivers, heavy and tractor-trailer	795	42.8	23.3
Truck drivers, light or delivery services	124	6.7	13.7
Industrial truck and tractor operators	79	4.2	25.1
Laborers and freight, stock, and material movers, hand	148	8	20
Packers and packagers, hand	17	0.9	41.4
Refuse and recyclable material collectors	28	1.5	26.8

NOTE: May not add to totals due to omission of occupations with small employment.

Source: U.S. Bureau of Labor Statistics

Employment Changes (Regional)

Employment growth in the Greater New Orleans region is expected to be low-to-moderate. The following table identifies the growth in employment in key occupations within this cluster.

Truck Drivers +2%
Packers +1.7%
Mechanics +2.7%
Managers +1.6%
Dispatchers +1.8%

According to the Louisiana Department of Labor, 9,860 people are employed in this

cluster in the Greater New Orleans region and no growth is expected. Given the potential for transportation and warehousing opportunities in southeastern Louisiana, the location quotient for this segment was surprisingly low at 1.07, meaning that most of the employment in this industry supports the local base of demand for products that are being transported within the region.

Conclusion

Slow growth is projected, as this sector does not have the concentration or critical mass needed to be competitive with other regions in the South. However, as other clusters develop, these services could see increased demand, with concurrent demand increases for skilled positions such as truck drivers, packers, and dispatchers.

Food and Consumer Products Cluster

Workers in the food processing industry link farmers and other agricultural producers with consumers. They do this by processing raw fruits, vegetables, grains, meats, dairy and other products into finished goods ready for the grocer or wholesaler to sell to households, restaurants, or institutional food services.

Food processing workers perform tasks as varied as the many foods we eat. For example, they slaughter, dress, and cut meat or poultry; process milk, cheese, and other dairy products; can and preserve fruits, vegetables, and frozen specialties; manufacture flour, cereal, pet foods, and other grain mill products; make bread, cookies, and other bakery products; manufacture sugar and candy and other confectionery products; process shortening, margarine, and other fats and oils; produce alcoholic and nonalcoholic beverages; prepare packaged seafood, coffee, potato and corn chips, and peanut butter. This list is not exhaustive by any means — food processing workers also play a part in delivering numerous other food products to our tables.

The following table shows that (on a national level) about 30 percent of all food processing workers are employed in plants that produce meat products, and another 25 percent work in establishments that make bakery goods and preserved fruits and vegetables. Sugar and confectionery products, the smallest sector of the food processing industry, account for only roughly 5 percent of all jobs.⁷⁸

Key Occupations

The key occupations within this industry cluster in the Greater New Orleans region are: Line Worker, Shift Supervisor, Process Engineer, Maintenance Workers, and System Operators.

⁷⁸ Source: U.S. Bureau of Labor Statistics

Wages (Regional)

The earnings of key occupations average less than all other clusters in the region (\$8.72/hr). Bread and pastry bakers and food batch makers are the only occupations in the local cluster to have higher hourly earnings than other southern cities.

Training Sources Used

In conjunction with Delgado Community College, the MetroVision Food Cluster designed an entry-level food industry training course, the first class of which began in August 2002. The course was funded by Workforce Investment Act Youth training. MetroVision is currently working in conjunction with the employers who hired graduates of this class and Delgado to further streamline and customize the training program.

In addition, the Louisiana Technical College is utilized for recruitment into higher positions, and the Reserve, LA campus is utilized by the sugar production industry for production management, process technicians and sugar boiler repair people.

Employment Changes (National)

In 2000, the food processing industry provided nearly 1.7 million jobs. Almost all employees are salaried workers, but a few food processing workers are self-employed.⁷⁹ In 1997, about 11,900 establishments processed food, more than half employing fewer than 20 workers.⁸⁰ Nevertheless, establishments employing 100 or more workers accounted for 80 percent of all jobs.

The employment distribution in this industry varies widely. The vast majority of employees work in the meat products sector. Employment in this sector has increased over the past 15 years. However, this industry is very dependent on technological advances and the demand for meat in the United States and abroad. The fruit and vegetable, bakery and beverage sectors also employ a fairly large portion of industry workers, but employment in each of these areas has been declining over the same 15 year period.

Food processing workers are found in all states, although some sectors of the industry are concentrated in certain parts of the country. For example, Arkansas, Georgia, Iowa, North Carolina and Texas employ more than a third of workers in meat-producing industries. Wisconsin has more cheese-processing workers than any other state. Similarly, most workers producing chewing gum work in Illinois and Pennsylvania. California accounts for most of the canned, frozen and preserved fruit, vegetable and food specialty workers, and together with Illinois, Pennsylvania and New York, employs a third of all workers

⁷⁹ Source: U.S. Bureau of Labor Statistics

⁸⁰ Source: U.S. Bureau of Labor Statistics

who produce packaged bakery products. Employment in raw cane sugar processing is concentrated in Florida, Hawaii and Louisiana.⁸¹

Employment in food processing by industry segment, 2000 and projected change, 2000-10 (Employment in thousands)		
Industry segment	2000 Employment	2000-2010 Percent change
Total employment	1684	-3
Meat Products	504	7.6
Preserved fruits and vegetables	220	-11.3
Bakery products	204	-6.4
Beverages	187	-12
Miscellaneous food products	180	3
Grain mill products and fats and oils	152	-1.1
Dairy products	146	-16.8
Sugar and confectionery products	92	-7.9

U.S. Bureau of Labor Statistics

Employment Changes (Regional)

The Louisiana Department of Labor predicts that regional employment in this cluster will decrease from 5,860 to 4,920 by 2008; however, MetroVision research indicates that there will be some employment increases in the following key occupations of the cluster.

Line Worker 1.3%
Supervisor 1.4%
Plant Engineer 1.70%
Maintenance 1.8%
System Operators 2.4%.

Conclusion

Low to moderate growth is projected due to the moderate growth of food processing companies in the region. Louisiana food will continue to increase in popularity, as people continue to stay closer to home and look for diversity in their meals. However, increased competition from producers not in the region will cut into that growth. The industry will concentrate on retaining productive workers and developing career paths.

Information Technology/E-Commerce Cluster

All organizations today rely on computer and information technology to conduct business and operate more efficiently. Often, however, these institutions do not have the resources to effectively implement new technologies or to satisfy their changing needs. When this

⁸¹ Source: U.S. Bureau of Labor Statistics

happens, they rely on the computer and data processing services industry to meet their specialized needs on a contractual or customer basis. Firms may enlist the services of one of over 178,000 establishments in the information technology and data processing services industry for help with a particular project or problem, such as setting up a secure website or establishing an online marketplace.⁸² Alternatively, they may choose to outsource one or more activities, such as the management of their entire data center or help-desk support center to an information technology and data processing services firm.

Services provided by this industry include prepackaged software; customized computer programming services and applications and systems software design; data processing, preparation and information retrieval services including online databases and Internet services; integrated systems design and development and management of databases; onsite computer facilities management; rental, leasing, and repair of computers and peripheral equipment; and a variety of specialized consulting services. Computer training contractors, however, are grouped with educational services, and establishments that manufacture and sell computer equipment are included with electronic equipment manufacturing.

Electronic business (e-business) is any process that a business organization conducts within a computer-mediated network. Electronic commerce (e-commerce) is the part of e-business that involves the purchase and sale of goods and services. With the growth of the Internet and the expansion of electronic commerce, some service firms specialize in developing and maintaining websites for client companies. Others create and maintain corporate Intranets or self-contained internal networks linking multiple users within an organization by means of Internet technology. These firms design sophisticated computer networks, assist with upgrades or conversions, and engage in continual maintenance. They help clients select the right hardware and software products for a particular project, and then develop, install, and implement the system, as well as train the client's users. Service firms also offer consulting services for any stages of development throughout the entire process, from design and content development to administration and maintenance of site security.

This widespread use of the Internet and Intranets also has resulted in an increased focus on security. The robust growth of electronic commerce highlights this concern, as firms seek to attract as many potential customers as possible to their websites. Security threats range from damaging computer viruses to online credit card fraud. Services outsourced to security consulting firms include analyzing vulnerability, managing firewalls and providing intrusion and antivirus protection.

Employment in information technology and data processing services grew by more than 1.3 million jobs from 1990 to 2000.⁸³ In 2000, there were about 2.1 million salaried jobs, and an additional 164,000 self-employed workers, making the industry one of the largest in the economy.⁸⁴ Most self-employed workers are independent consultants. Since the

⁸² Source: U.S. Bureau of Labor Statistics

⁸³ Source: U.S. Bureau of Labor Statistics

⁸⁴ Source: U.S. Bureau of Labor Statistics

late 1980s, employment has grown most rapidly in the computer programming services, information retrieval services, and prepackaged software segments of the industry. From 1990 to 2000, about 368,000 jobs were created in programming services, 196,000 in information retrieval services, and another 187,000 in prepackaged software.⁸⁵

While the industry contains both large and small firms, the average establishment in information technology and data processing services is relatively small; approximately 80 percent of establishments employed fewer than 10 workers.⁸⁶ The majority of jobs, however, are found in establishments that employ 50 or more workers.⁸⁷ Many small establishments in the industry are startup firms that hope to capitalize on a market niche.⁸⁸ According to the table of the employment by each sector in the IT Industry provided by the U.S. Bureau of Labor Statistics, 22.1% of the jobs are in sales, administration, and management and financial positions. Many of the smaller companies do not have positions that are entirely dedicated to sales, management, or financial management, so we can assume that all of these positions are in businesses in the IT sector employing 50+ employees. Many industry reports state that the IT industry (as a whole) is highly fragmented when all of the aspects of this industry are included; therefore, we can reasonably assume that the remaining 77.9% of the positions in this industry are equally divided between firms having more than fifty employees and those having less than fifty employees. Based on this data, we estimate that 61.05% of the jobs in this industry are with firms employing more than fifty employees.

Relative to the rest of the economy, there are significantly fewer workers 45 years of age and older in information technology and data processing establishments; this industry's workforce remains younger than most, with large proportions of workers in the 25 to 44 age range.⁸⁹ This reflects the industry's explosive growth in employment since the early 1980s. The huge increase in employment afforded thousands of opportunities to younger workers possessing the newest technological skills.

Key Occupations

The key occupations within this industry cluster in the Greater New Orleans region are: Systems Analysts, Computer Programmers, Computer Support Specialists, and Installers/Repairers.

Wages (Regional)

Earnings averaged much less than largest southern metro areas such as Houston, Dallas, Atlanta and Jacksonville, all of which have concentrations in this industry. The earnings compare for occupations such as line installers/repairers and computer support specialists, as New Orleans region earnings are higher than both southern and national

⁸⁵ Source: U.S. Bureau of Labor Statistics

⁸⁶ Source: U.S. Bureau of Labor Statistics

⁸⁷ Source: U.S. Bureau of Labor Statistics

⁸⁸ Source: U.S. Bureau of Labor Statistics

⁸⁹ Source: U.S. Bureau of Labor Statistics

averages.

Training Sources Used

A variety of industry-certified courses are utilized for specific skills. Examples are Microsoft, Cisco and Oracle certified courses. Most positions require a degree for entry, and programming/networking courses offered by UNO and Delgado Community College are used in certain instances for specific needs. With the exception of repair technicians and installers, most positions require a degree for entry, although there are many instances when a person is highly talented and leaves his education early to enter the workforce.

Employment Changes (National)

The information technology and data processing services industry grew dramatically over the past decade and in the year 2000 salaried employment was projected to grow about 86 percent by the year 2010⁹⁰. However, recent downturns in the industry beginning in early 2001, not reflected in the Bureau of Labor Statistics numbers, have changed the employment outlook for the industry. At the current time, there is neither a regional nor a national shortage of qualified workers in the information technology field. The best opportunities will be for professional and related occupations, reflecting the continued demand for higher level skills to keep up with changes in technology.

An increasing reliance on information technology, combined with falling prices of computers and related hardware, means that individuals and organizations will continue to turn to information technology and data processing service firms to maximize the return on their investments in equipment and to fulfill their growing information technology needs. Such needs include the expansion of electronic commerce, a growing reliance on the Internet, faster and more efficient internal and external communication, and the development of new technologies and applications. With increasing global competition and rising costs, organizations must be able to obtain and manage the latest information in order to make business decisions. In turn, the current downturn is not expected to last, and the demand for information technology workers is expected to rebound in the near future.

⁹⁰ Source: U.S. Bureau of Labor Statistics

Employment of wage and salary workers in computer and data processing services by occupation, 2000 and projected change, 2000-10 (Employment in thousands)

Occupation	Employment, 2000		Percent change, 2000-10
	Number	Percent	
All occupations	2,095	100	86.2
Management, business, and financial occupations	370	17.6	78.4
Marketing and sales managers	28	1.3	87.5
Computer and information systems managers	62	3	81.3
Engineering managers	18	0.9	48.2
Financial managers	16	0.8	81.3
General and operations managers	54	2.6	71.3
Management analysts	30	1.4	113.8
Accountants and auditors	16	0.8	81.3
Professional and related occupations	1,118	53.3	105.7
Computer programmers	231	11	43.2
Computer and information scientists, research	9	0.4	73.8
Computer systems analysts	135	6.5	99.4
Computer software engineers, applications	194	9.3	144.8
Computer software engineers, systems software	124	5.9	144.8
Computer support specialists	137	6.5	144.8
Database administrators	25	1.2	103.6
Network and computer systems administrators	55	2.6	144.8
Network systems and data communications analysts	36	1.7	117.6
All other computer specialists	41	2	120
Computer hardware engineers	15	0.7	63.4
Sales and related occupations	113	5.4	54.5
Sales representatives, wholesale and manufacturing, technical and scientific products	29	1.4	24.9
Office and administrative support occupations	412	19.7	52.5
First-line supervisors/managers of office and administrative support workers	29	1.4	38
Bookkeeping, accounting, and auditing clerks	29	1.4	56.1
Information and record clerks	95	4.5	67
Customer service representatives	60	2.9	71.5
Computer operators	22	1	8.6
Data entry keyers	69	3.3	34.7
Office clerks, general	33	1.6	81.3
Executive secretaries and administrative assistants	35	1.6	63.2
Secretaries, except legal, medical, and executive	16	0.7	45
Installation, maintenance, and repair occupations	40	1.9	67.5
Computer, automated teller, and office machine repairers	24	1.1	61.3
Production occupations	18	0.9	62.5

NOTE: May not add to totals due to omission of occupations with small employment.

Source: U.S. Bureau of Labor Statistics

Employment Changes (Regional)

The projected growth rates in the regional cluster are significantly lower than the projected growth rates for the national outlook. The following table identifies the growth in employment in key occupations of the cluster as of 2000. The rates of growth have obviously declined in the past two years.

Systems analysts +9.0%
Computer programmers +4.0%
Support specialists +8.6%
Installers/repairers +3.5%.

Retirement Driven Employment Changes

Because this cluster represents a relatively new industry, many industry employees are young. However, hiring needs created by the retirement of existing workers will rise on an increasingly steep slope over the next 15 years.

Conclusion

The rapid decline of growth in this industry will keep demand low for the near term. However, long-term growth forecasts are still very high and much depends on the ability of the economy as a whole to rebound. The area cluster's strong initiative to attract major federal information technology contractors could also cause a rebound in growth; however, according to cluster leaders there is a more than adequate labor supply to fill that demand.

Life Sciences Cluster

Industry Overview

Healthcare is one of the largest industries in the country, with more than 11 million jobs, including the self-employed.⁹¹ According to the Bureau of Labor Statistics, 13 percent of all salaried jobs created between 2000 and 2010 will be in health services. Nine of the twenty occupations projected to grow the fastest during that 10 year period are concentrated in allied health services. Most jobs require less than four years of college education.⁹²

More than 469,000 establishments make up the health services industry; they vary greatly in terms of size, staffing patterns, and organizational structures.⁹³ Two-thirds of all private health services establishments are offices of physicians or dentists. Although hospitals constitute less than 2 percent of all private health services establishments, they employ nearly 40 percent of all workers.⁹⁴ When government hospitals are included, the proportion rises to 45 percent of industry workforce.⁹⁵

Percent distribution of wage and salary employment and establishments in private health services, 2000		
Establishment type	Establishments	Employment
Total, health services	100	100
Hospitals, private	1.6	39.3
Offices of physicians including osteopaths	41.1	19.7
Nursing and personal care facilities	4.5	17.9
Offices and clinics of dentists	23.8	6.8
Home healthcare services	3.1	6.3
Offices of other health practitioners	19.2	4.4
Health and allied services, not elsewhere classified	3.3	3.5
Medical and dental laboratories	3.5	2.1

Key Occupations

Nineteen key occupations in the Greater New Orleans region were identified for this cluster, which is the largest of any identified cluster.

⁹¹ Source: U.S. Bureau of Labor Statistics

⁹² Source: U.S. Bureau of Labor Statistics

⁹³ Source: U.S. Bureau of Labor Statistics

⁹⁴ Source: U.S. Bureau of Labor Statistics

⁹⁵ Source: U.S. Bureau of Labor Statistics

Nurses-RNs	Clinical Engineers – biomed
Healthcare Faculty – instructors	Medical coders & transcriptionists
Pharmacy tech & regular pharmacist	Radiation therapists
Dental hygienist & assistant	Physicist
Phlebotomy lab	Research engineer – peptides
Radiology techs & ultrasound techs	Respiratory therapists & techs
Cystologists	Research Engineer
Physicist	Respiratory Therapist/Tech
Radiation Therapy	Clinical Engineer

Wages (Regional)

The earnings of employees of entities belonging to this cluster are moderately less than the southern and national averages; however, three positions vary from this pattern: medical and psychiatric social workers, occupational therapists and physical therapists. Cardiology technologists are also higher than the southern average.

Training Sources Used

Delgado has a strong program for imaging technicians, but currently accepts only a small number of students (50) for the class.

Southern Medical in Baton Rouge graduates ultrasound technicians but they are in short supply and mainly stay in Baton Rouge

Transcriptionists receive certification through program coursework but then need on the job experience. They are the coders that take physician diagnosis and match them with one of 3000 Medicare codes, which determine reimbursement. UNO and Delgado offer the certification which would be followed by on the job training.

Tenet provides training for health information technicians to collect patient paperwork, discharge info et cetera to input into system for bill processing.

In the cluster forums held in conjunction with this research, representatives from area hospitals stated that the phlebotomy training programs currently in place with area institutes do not put out quality workers. There is a need for internal hospital training

Employment Changes (National)

Wage and salary employment in the health services industry is projected to increase more than 25 percent through 2010, compared with an average of 16 percent for all industries.⁹⁶ Employment growth is projected to amount to roughly 2.8 million new jobs—13 percent of all salaried jobs added to the economy over the 2000-2010 period.

⁹⁶ Source: U.S. Bureau of Labor Statistics

Projected rates of employment growth for the various segments of this industry range from 10 percent in hospitals, the largest and slowest growing industry segment, to 68 percent in the much smaller home healthcare services.⁹⁷

Employment of wage and salary workers in health services by occupation, 2000 and projected change, 2000-10 (Employment in thousands)			
Occupation	Employment, 2000		Percent change, 2000-10
	Number	Percent	
All occupations	11,065	100	25.5
Management, business, and financial occupations	546	4.9	27.3
Medical and health services managers	167	1.5	34.9
Business operations specialists	87	0.8	19.2
Professional and related occupations	4,975	45	26.9
Social workers	110	1	37.2
Dentists	86	0.8	13.7
Physicians and surgeons	459	4.1	27.8
Registered nurses	1,774	16	25.3
Physical therapists	109	1	36.7
Medical and clinical laboratory technologists	133	1.2	18
Medical and clinical laboratory technicians	121	1.1	18.9
Dental hygienists	142	1.3	37.1
Radiologic technologists and technicians	159	1.4	23.5
Health diagnosing and treating practitioner support technicians	210	1.9	23.9
Licensed practical and licensed vocational nurses	552	5	18.8
Medical records and health information technicians	118	1.1	54.1
Service occupations	3,275	29.6	29.5
Dental assistants	237	2.1	37.8
Home health aides	261	2.4	59.6
Nursing aides, orderlies, and attendants	1,053	9.5	21.7
Medical assistants	301	2.7	59.8
Medical transcriptionists	87	0.8	30.3
Food preparation workers	98	0.9	15.4
Food and beverage serving workers	97	0.9	3.9
Janitors and cleaners, except maids and housekeeping cleaners	93	0.8	21.9
Maids and housekeeping cleaners	245	2.2	12.4
Personal and home care aides	160	1.4	66.8
Office and administrative support occupations	1,987	18	16
First-line supervisors/managers of office and administrative support workers	147	1.3	3.3
Billing and posting clerks and machine operators	166	1.5	29
Bookkeeping, accounting, and auditing clerks	96	0.9	15.6
Receptionists and information clerks	288	2.6	26.6
Office clerks, general	264	2.4	12.2
Medical secretaries	280	2.5	20
Secretaries, except legal, medical, and executive	144	1.3	2.1
Installation, maintenance, and repair occupations	80	0.7	9.8
Production occupations	118	1.1	13.7

NOTE: May not add to totals due to omission of occupations with small employment.

Source: U.S. Bureau of Labor Statistics

⁹⁷ Source: U.S. Bureau of Labor Statistics

Employment Changes (Regional)

The projected local growth rates in this cluster are high, but they are lower than the projected growth rates for the national outlook. The following table identifies the growth in employment in key occupations of the cluster.

Nurses +1.8%
Home health aids +6.2%
EMT/Paramedics +3.8%
Medical Records Tech +4.1 %.

The Louisiana Department of Labor estimates that 61,650 people are employed by the Allied Healthcare Industry. It is estimated that by 2008, employment in this industry will total 74,260.

Retirement Driven Employment Changes

The less skilled professions in this industry have a relatively high rate of turnover. As a result of the training and education required for the more skilled positions as well as the increasing industry growth which results in increased job demand, hospitals and other healthcare entities are in top hiring mode.

Additional jobs will be created as a result of retirement, but those employed in this cluster tend to work longer before retiring. However, the U.S. Bureau of Labor Statistics does state that healthcare sector workers tend to be older than workers in other industries, for example, in Louisiana, of nearly 37,000 RNs licensed and residing in the state, more than half are over the age of 40 and only about 5,000 are under the age of 30.⁹⁸

With the lack of data and the sensitivity of age issues in the workplace, it is difficult to quantify the exact level of job openings caused by retirement.

Conclusion

Increased healthcare needs associated with the aging population of ‘baby boomers’ as well as generally longer life spans, will continue to drive strong growth in the health care industry. This fact, coupled with specific shortages of professionals to fill critical positions such as nurses and pharmacists, calls for immediate action. Biomedical positions will also experience growth as the region continues to attract medical research.

⁹⁸ Source: Louisiana Hospital Association

Research Summary

The average New Orleans earnings exceeded the southern average in four clusters, but were lower in five. The average earnings generally exceeded those of smaller metro areas such as Shreveport, Mobile, Jackson, but were lower than those of larger metropolitan areas and similar to those of relatively equal metropolitan areas.⁹⁹

How the Louisiana Department of Labor Compiles its Employment Projections

Many of the employment projections for the Greater New Orleans region in the preceding paragraphs were compiled by the Louisiana Department of Labor. The following information outlines how these projections are compiled.

In compiling employment projections, the Louisiana Department of Labor uses three analytical techniques to determine the most in-demand occupations.

- (1) Develop industry growth projections
- (2) Develop occupational projections
- (3) Identify the most in-demand occupations

Occupational growth is directly related to industry growth. If an industry experiences economic growth then occupations concentrated in that industry will grow. Conversely, if demand for a specific occupation is projected to decline, this decline can be attributed to the decline of the industry in which it is concentrated. Changes in technology or business practices can also reduce the demand for an occupation within an industry.

Historical data reported through the Covered Employment and Wages Program, or ES-202, is used as the primary source of data in developing industry employment projections. This program is responsible for the accurate reporting of employment and wages for Louisiana employers who pay unemployment insurance taxes. Employers are required by federal law to report this information on a quarterly basis. All establishments are assigned a Standard Industrial Classification (SIC) code and parish code, so that the employment for each of the firms is recorded in the correct industry set and in the accurate physical location.

The industrial employment projections are then translated into occupational employment projections by using the data collected in the Occupational Employment Statistics (OES) survey. Both of these data sets are imported into the MicroMatrix System, a software program used to produce occupational projections. Additional data sets that supplement the survey data include national replacement rates (a rate used to estimate the number of workers either retiring or terminating employment); change factors (factors that account for the change in the occupational mix of an industry); and estimates of the volume of self-employed individuals and state-specific federal employment numbers.

⁹⁹ Source: U.S. Bureau of Labor Statistics

Finally, the top in-demand occupations are determined from the occupational projections taking into account total occupational demand and growth. The Louisiana Department of Labor and the Occupational Forecasting Conference review these projections.

CHAPTER 5: Analysis and Recommendations

The workforce development challenge faced by the Greater New Orleans regional economy is not dissimilar to challenges that confront other metropolitan regions throughout the developed world. It is, quite simply, a race. The race to develop the most productive people and put them on paths of lifelong learning and increased productivity is not easily won. However, the cost of losing this race is extremely high. The historically high rate of high school dropouts within the Greater New Orleans region poses an additional disadvantage to our geographic area.¹⁰⁰ These are key issues that were reviewed in the scope of the New Orleans Regional Community Audit process. In presenting solutions to the workforce development challenges faced by our region, the overwhelming consensus was that communication is truly the critical element that we must prioritize in meeting these challenges. Ultimately, for our region to achieve sustainable, widespread growth and development, all stakeholders must be connected as closely as possible in a partnership working to achieve market-driven results. Stakeholders that must be included in this partnership include industry, government, education and the current and future workforce as well as government agencies and youth services working to lower high school dropout rates and inform our regional youth of the careers and lifestyles available to them through career tracks for in-demand professions within our region.¹⁰¹

While all industry clusters are of vital importance to the regional economy, the scope of this project requires that they be prioritized according to their impact and the severity of need for specific skills. Based on research and analysis previously compiled by DADCO Consulting in a 2002 study of the Greater New Orleans regional economy, the following clusters and occupations are most critical for the region to prosper:

1. Maritime, including Shipbuilding:
 - a. Millwright
 - b. Pipefitter
 - c. Machinist
 - d. Mechanic

Information on the nature of the work and the career pathways into these jobs from the Bureau of Labor Statistics can be found in the Career Guide in Appendix A.

2. Healthcare/Life Sciences
 - a. Home Health Worker
 - b. Nurses
 - c. Medical Records Tech
 - d. Physician's Assistant

¹⁰⁰ Source: Louisiana Workforce Commission

¹⁰¹ Source: Montana Associated Technology Roundtable Newsletter, September, 2002

Information on the nature of the work and the career pathways into these jobs from the Bureau of Labor Statistics can be found in the Career Guide in Appendix B.

3. Information Technology/E-Commerce
 - a. Computer Programmers
 - b. Systems Analysts
 - c. Computer Support Specialists
 - d. Repair Technicians

Information on the nature of the work and the career pathways into these jobs from the Bureau of Labor Statistics can be found in the Career Guide in Appendix C.

4. Food/Consumer Products
 - a. Systems Operators
 - b. Process Engineers
 - c. Systems Maintenance
 - d. Line Operator

Information on the nature of the work and the career pathways into these jobs from the Bureau of Labor Statistics can be found in the Career Guide in Appendix D.

5. Petrochemical
 - a. Equipment Operators
 - b. Equipment Maintenance
 - c. Machinery Supervisors
 - d. Chemical Engineers

Information on the nature of the work and the career pathways into these jobs from the Bureau of Labor Statistics can be found in the Career Guide in Appendix E.

6. Oil/Gas
 - a. Petroleum Engineers
 - b. Geologists
 - c. Drillers/Roughnecks
 - d. Service Operators (offshore)

Information on the nature of the work and the career pathways into these jobs from the Bureau of Labor Statistics can be found in the Career Guide in Appendix F.

7. Entertainment
 - a. Production Crew Members
 - b. Gaffers/Grips
 - c. Food service and Hotel/Motel Managers
 - d. Sound Technicians

Information on the nature of the work and the career pathways into these jobs from the Bureau of Labor Statistics can be found in the Career Guide in Appendix G.

A primary example of the need to continuously monitor and rapidly adjust to changes in workforce skill needs can be found in the region’s entertainment industry. According to the U.S. Bureau of Labor Statistics Employment Growth Forecast for 2000-2010, the following growth rates will occur in these two key sectors of the regional Arts and Entertainment industry:

	<u>National</u>	<u>Louisiana</u>
Film and Video	27%	14%
Music Production	17%	16%

In 2001, Charles Bush of Warner Brothers stated that movie production in Louisiana had dropped from a \$90-million impact in 1993 to \$30 million in 2001. However, in large part as a result of key legislation passed in the April 2002 State of Louisiana Special Legislative Session, Louisiana currently has commitments for motion picture productions in excess of \$100 million.¹⁰² Smith states that the exponential indirect impact of these dollars will result in a total estimated economic impact of \$350 million to the Louisiana economy.

In further quantifying the impact, the Washington, DC Film Commission estimates that a single feature film can create an economic impact of \$1 million to \$6 million in the local community, in part through the 300-1,000 freelance cast and crew jobs created, depending on the size of the production. The Motion Picture Association of America estimates that the average price for each motion picture is \$25 million. Based on the current level of \$100 million of motion picture spending in Louisiana, we can assume that this will amount to four pictures and at least 1,200 jobs (based on the low level of the Washington Film Office projection).

Lonny Kaufman, the Louisiana Department of Economic Development’s Entertainment Cluster Director states that: “As a result of this continuous work coming to Louisiana we will be able to address some of the missing components of our infrastructure including job training for these high paid jobs that do not necessarily require a college degree.” The need of the workforce development system to identify these “missing components” and rapidly respond with needed skills in the region’s dominant clusters is paramount.

In order to project the types of jobs that may be created in the Greater New Orleans Region, we used the U.S. Bureau of Labor Statistics table in the following graphic and used the industry percentages for the estimated 1,200 jobs that may be created. Because many of the management positions are with studios that are not based in Louisiana, our analysis excluded these positions and inserted them into the “other production occupations category.”

¹⁰² Source: Mark Smith, Film Commissioner, The Louisiana Film Commission.

Table 1. Employment of wage and salary workers in motion picture production and 2000-10 (Employment in thousands)			(Employment in Actual Units) Projected for Greater New Orleans Region
Occupation	Employment, 2000		Number
	Number	Percent	
All occupations	287	100	
Management, business, and financial occupations	18	6.4	
General and operations managers	5	1.9	
Business operations specialists	2	0.9	
Financial specialists	2	0.7	
Professional and related occupations	110	38.3	
Computer specialists	6	2	24
Multi-media artists and animators	4	1.2	14
Actors	25	8.6	103
Producers and directors	8	2.7	32
All other entertainers and performers, sports and related workers	33	11.5	138
Writers and editors	3	0.9	11
Audio and video equipment technicians	7	2.5	30
Broadcast technicians	2	0.7	8
Sound engineering technicians	3	1.1	13
Camera operators, television, video, and motion picture	5	1.7	20
Film and video editors	5	1.8	22
All other media and communication equipment workers	3	1	12
Service occupations	5	1.7	
Security guards	2	0.7	8
Sales and related occupations	8	2.7	
Sales representatives, wholesale and manufacturing, except technical and scientific products	2	0.9	11
Office and administrative support occupations	58	20.3	
Customer service representatives	4	1.5	18
Production, planning, and expediting clerks	24	8.3	100
Shipping, receiving, and traffic clerks	6	2.2	26
Office clerks, general	6	2	24
Executive secretaries and administrative assistants	3	1	12
Installation, maintenance, and repair occupations	11	4	
Maintenance and repair workers, general	10	3.4	41
Production occupations	6	1.9	
Other production occupations	3	1.1	238
Transportation and material moving occupations	70	24.5	
Industrial truck and tractor operators	12	4.2	50
Laborers and freight, stock, and material movers, hand	12	4.2	50
Packers and packagers, hand	7	2.3	28
All other material moving workers	32	11.1	133
			1,200

Chapter 5 Summary

Although these occupations are deemed most critical, there are many more very important occupations highlighted throughout this report. Conversely, there are many, many actions that need to be taken from the labor demand perspective of business and industry. The demand is great; the race is more like a marathon than a sprint. This metaphor is important: the race will not be won in increments of days, weeks, or months. Progress should be measured in years of constant vigilance and hard work. This report recommends the following initiatives that should be embarked upon in furthering the Greater New Orleans region's position in the race. They fall into five areas:

1. Build and strengthen on-going, dynamic communication channels between area industry cluster groups and education/workforce resource providers, government and youth service agencies.¹⁰³
2. Develop specific occupational skill tracks for career pathways for the future workforce as well as current workforce that is underemployed/unemployed. Career pathways must be based on industry cluster demand that can be easily utilized by employees and employers.
3. Improve basic skills and work readiness skills for the future workforce as well as underemployed/ unemployed workers.
4. Promote awareness of skilled trade careers of new entrants to the workforce as well as to the underemployed/unemployed. An emphasis should be placed on actively facilitating successful completion of education, skill development, and entry into the workforce for high school and college dropouts.
5. Expand connections between career services/employee recruitment professionals and industry to streamline and otherwise improve employee placement systems as well as to promote the establishment of standard career pathways recognized by business and industry.

The Regional Partnership should organize a series of working groups. Each working group would be charged with developing an action agenda to implement one of these initiatives.

¹⁰³ Youth Service Agencies such as the YMCA, Junior Achievement, Covenant House, etc. are mentioned here because the root cause of many workforce problems lie in high school dropout which oftentimes ultimately results in a menial job with little or no hope for advancement. It is important that lines of communication be opened with these youth service agencies and organizations to help them to strengthen and expand their mission and message to entice young people to stay in school, develop life skills and embark on a career track.

Specific Recommendations

- 1. The Regional Community Audit Partnership should immediately launch a portal to provide current labor market information specific to our geographic region that can be used by area employers, Workforce Investment Boards, human resource departments, k-12 school districts, community/technical colleges & universities for curriculum planning and area jobseekers in addition to the city and parish government.**

The data on this portal should combine statistical data as well as employer-driven qualitative, anecdotal information on the regional labor market. A section within this portal through which industry, government, education, and youth service programs can communicate regularly is also an important function that should be contained within the portal.

To supplement the data contained within the portal, the Community Audit Partnership should also convene regular working group meetings with MetroVision’s cluster leadership to foster personal communication and relationship building.

An internet-based portal should be designed to perform the following functions:

- I. The ultimate goal of this portal is to have the region’s industry, jobseekers, WIBs, educational institutions, service providers, and government making informed workforce decisions based on current standard, common data on regional wages, in-demand occupations, career pathways, skill standards, training/education offering and all other elements of the workforce development system. This information has the power to truly bridge existing gaps between industry, education, government, federal and state workforce funds and programs, job seekers, economic developers and a whole range of entities.**

The labor market information contained within this portal will allow:

- a. Business and industry to set wages, anticipate labor demand, develop well-rounded, complete job descriptions, career pathways and industry skill standards, become aware of programs offered by the workforce development system for recruitment, training, and retention of quality employees. The site would act as a central clearinghouse for all of this information.**
- b. Educational institutions from k-12 to technical and community colleges and universities, to anticipate the hiring needs of business and industry and train for those needs. Educational institutions will be able to use this portal to develop an understanding of career pathways and the needed skill sets types of training needed for in-demand careers, so that graduates of their institutions can step much more seamlessly into the working world. Educational institutions will be able to**

align their curriculum offering with the true needs of business and industry so that they can recruit students for in-demand programs, and place graduates in sustainable, upwardly mobile careers upon graduation.

- c. The Workforce Development system to communicate the range of programs that it offers to business and industry as well as city and parish government and economic developers.

A successful benchmark portal, can be found at www.pprc.umsl.edu/wis/ the Greater St. Louis Region's website created and maintained by the University of Missouri at St. Louis.

Another example of an well-regarded portal with labor market information is the ERISS labor market information system (www.eriss.com). Like the University of Missouri system, ERISS uses call center technology to gather real-time data on a frequent basis to provide the region with the most reliable data possible. These two systems use a survey process to gather large amounts of primary data directly from regional industry in a minimally-invasive manner. This data is then analyzed and formatted for ready access by both companies and service/education providers.

Although the Louisiana Department of Labor has a useful statewide labor database, it does not contain the regionally focused, just-in-time information needed to meet the needs of industry. In both the cluster workshop and in interviews, not one of the industry representatives interviewed indicated that the LOIS system met all of their needs.

II. The portal should provide for continuous, dynamic communications as well as a series of interlocking operating relationships between the stakeholders. For each stakeholder, specific needs should be addressed. This can best be accomplished utilizing a "virtual office" platform. In the virtual office configuration, each industry cluster would have access to the following:

- a. A calendar of training and education courses that may be relevant to that cluster, with links to class descriptions, either on the page or on the website of the institution offering the training.
- c. A structured discussion area that may be accessed by industry, education, government, and youth service organizations to exchange information on industry needs, workforce training offerings, and open dialog on how to close gaps between the two.

These discussions should be monitored by members of the Partnership so that institutions and policy makers that can affect needed changes will be aware of both the need and potential support of these stakeholders.

Industry representatives, whether the owner/manager of a small business or the human resources manager of larger firms, should believe that this is a place where they can express their needs and have others listen and respond, and form active partnerships to

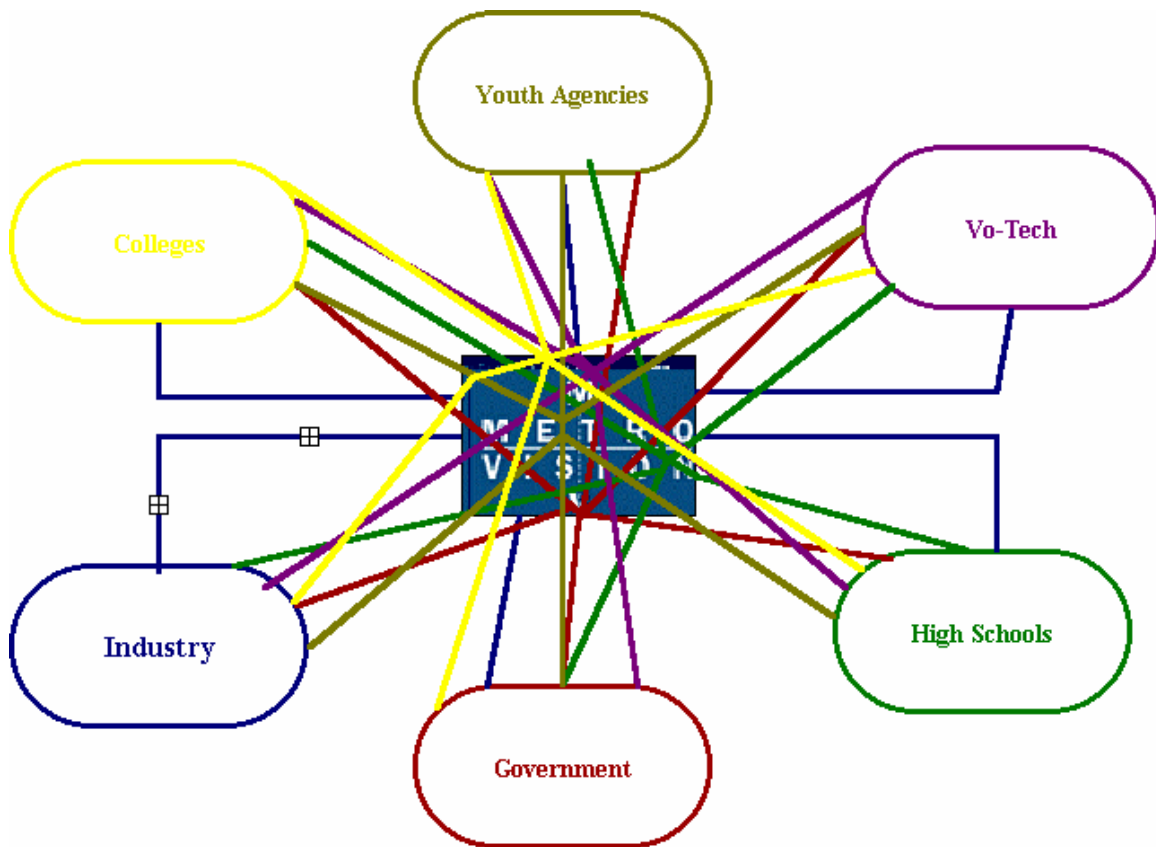
accomplish their workforce goals. For educational institutions and service providers, administrators and educators should believe that this is a place where they can find the true needs of industry, communicate their abilities and limitations, and work to develop support for policy and administrative changes that would make them more effective in meeting industry needs.

The desired end result of this portal is to connect regional stakeholders on a perpetual basis. The labor market information contained within the portal should act as a magnet, drawing stakeholders back into the portal on a regular basis, using the information on regional wages, hiring patterns, career pathways, skill standards etc. as they seek to educate, train, recruit and create jobs within the locate workforce system.

MetroVision has already organized itself around the region's dominant eight clusters, and the Partnership should develop a working partnership with MetroVision to implement and manage the communications portal. Under the Workforce Investment Act, provision has been made for investment in systems that would directly increase the ability of workforce skill providers to provide needed skills and education, and would increase the amount of private sector investment in workforce enhancement activities. A dynamic portal should meet both of these requirements.

Development of this LMI/communication portal would integrate the collaborative and market-driven principles of clusters into the goals of the workforce community audit. It would also provide the regional WIBs with constant, dynamic communication with the industries that most impact the future of the region. This action would clearly align the workforce investment boards with the industries they were designed to serve, and give the industry clusters most likely to increase wealth in the region a powerful competitive advantage. The ability of industry to communicate their needs as they arise, and have service providers and institutions respond immediately to those needs, can dramatically increase the rate of innovation, growth, profitability, employment, and wages paid by the region's industry clusters.

The development of the proposed portal and the resulting communication exchange between the stakeholders will take a considerable amount of time, energy, and money to implement. Funding for this project will have to come from a combination of Partnership member investment, industry contributions, government grants, and grants from private foundations such as the Ford Foundation, which have a particular interest in fighting poverty through economic development. A task force should be formed immediately to solicit full proposals and design layouts for the portal, and to review the existing University of Missouri at St. Louis system. These two elements should then be combined into a master proposal that could be used for fundraising purposes. The goal of the partnership should be to have the portal up and running by the first quarter of 2004.



2. **Members of The Regional Community Audit Partnership should become active participants in all of MetroVision’s cluster committees.** The Partnership should also begin to work with those committees to build standardized career pathways for critical occupations identified within each cluster. Cluster development, the discipline of increasing regional competitive advantage through strengthening the linkages between and among geographic concentrations of like or related industries with similar needs and market opportunities, has tremendous potential to drive effective workforce development. Because clusters foster ongoing, dynamic communication and technological development, education and skill development has been a cornerstone of the most successful regional cluster efforts worldwide. The Partnership should become an active partner throughout this process.

That involvement begins with active attendance and participation in MetroVision’s active cluster committees. A Partnership representative should contact the MetroVision staff member responsible for each cluster committee and ask for a meeting with the cluster committee chairs to explain their desire to participate and discuss the most effective way to accomplish a productive relationship with each cluster. In addition, participation in the development of a dynamic communications system would solidify the Partnership’s standing in this MetroVision initiative. Such an action would also show industry that the

Partnership has sincere desire to increase it's effectiveness and through this, the region's competitiveness.

4. Establish a mandate to fund comprehensive Life Skill programs designed to ensure employability and post-training job retention, as a key precursor to technical skill training. Such a program would focus on the new basic skills such as problem solving, teamwork and continuous improvement along with life skills such as communication, punctuality and work habits.

The University of Tulsa sponsors various Life Skills workshops available to individuals throughout the community that are in need of these skills. These workshops are an excellent way for the university to train its future social workers and could be duplicated by local universities that offer graduate programs in social work such as Tulane University and Southern University at New Orleans.

Another Life Skills program recognized as a national best case model is the Shreveport, La.-based Providence House (www.providencehouseshreve.com). Providence House primarily works with homeless families to add structure to their lives through programs such as an intensive eighteen-week Life Skills curriculum that includes intensive behavior modification practices. The program has an 89 percent success rate.¹⁰⁴ A survey done in 1997 found that for every \$1.00 invested in the Providence House program, \$4.00 is returned in savings to the taxpayers and \$5.00 is put back in the community through employment-generated returns.

Based on studies of the Greater New Orleans regional economy, dropouts would be the ones who would benefit the most from these programs.

The partnership between the Cabinet for Workforce Development's Department for Technical Education and the Kentucky Community and Technical College System, which allows technical education students to simultaneously enroll in high school and community or technical colleges and later transfer these credits, is perhaps the best model we have evaluated for addressing the career track and dropout problems. The current leaning of the government of the State of Louisiana tends towards "pay a little now for education or a lot later in the form of public assistance or corrections" –this indicates that funding for a similar program could possibly come from the public coffers.

¹⁰⁴ When a family graduates from the Providence House program they are drug and alcohol free, and the parents have received their high school diploma, GED or worked in a position congruent with their highest level of ability. Some have graduated from a training/education program with an accredited local institution. The family has completed a behavior modification program geared to instill successful living skills. They have saved 50 percent of their total income earned while in Providence House, maintained two budgets, worked full-time for 90 days and have housing and furnishings to begin over again. During their time at Providence House, they have become self-sufficient in the sense that they have not received other forms of public assistance.

4. Strengthen initiatives to increase collaboration and communication between k-12 and post-secondary education institutions. Programs such as the MetroVision School-to-Career Partnership, which exposes grammar and high school students to the range of existing career options, must be broadened in reach throughout our region and receive funding on a level commensurate with the key role that they play in the workforce development continuum.

On the post-secondary education front, an initiative must be launched to align the curriculum and scheduling options available through area universities, community and technical colleges, with the needs of the business community. The Labor Market Information Portal referred to in recommendation #1 can play a key middleman role through informing the education community of the key in-demand occupations, skill sets and competencies as reported by area business and industry so as to better orient their curriculum to fit labor demand. The relationships established between post-secondary education and business as well as the broadened skill sets of post-secondary graduates will, in turn, potentially promote the recruitment of area post-secondary graduates by area businesses and the retention these graduates within our geographic area.

5. Convene employers to launch a massive public relations campaign that highlights rewarding careers in skilled occupations. “The Best Careers Are Right Here!” or similarly themed campaigns could feature skilled craftsmen talking about the rewards of their career choices. The purpose of this campaign would be to 1) communicate the advantages and enhance the image of working in skilled trades and 2) promote the value of lifelong learning.

6. Integrate the Work Keys system into the Partnership’s community audit efforts. The Work Keys system developed by ACT (formerly American College Testing, the entity which created the ACT college test) is a system that provides a framework for profiling, testing against and comparing skill levels for key positions within an industry. As detailed on their web site, www.act.org/workkeys, Work Keys functions on the 3 following levels:

- a. Working with experienced employees, authorized Work Keys Job Profilers evaluate key skills and levels of competency required for specific jobs within a company.
- c. Standardized Work Keys skill assessments are administered to job applicants or current employees to pinpoint their skill levels in up to eight critical areas.
- c. Subsequently, the skill levels demonstrated by each test taker are compared to the minimum skill levels required for the profiled jobs, enabling the company to immediately evaluate a job applicant’s qualifications or, in the case of a current employee, to determine that employee’s training needs.

Work Keys job profiles accomplish the key task of job analysis, helping employers identify the levels of skills current and prospective employers need in order to be successful on the job. Job profiles also provide individuals with a clear picture of the skill levels that they need to qualify for and be successful in the jobs they want. Positions are profiled using a framework of eight of ten potential areas—Reading for Information, Applied Mathematics, Applied Technology, Business Writing, Listening, Locating Information, Observation, Readiness, Reading for Information, Teamwork, and Writing. Each skill is addressed by a distinct skill scale, developed with the help of businesspeople and educators. Specific jobs are then profiled according to the skill level needed for each area on a declining numerical scale, by which individual scores are compared.

The gaps between needed skill levels and individual test results allow the Work Keys test reviewer to immediately pinpoint gaps between the needed skills and current applicant skill levels. Applicants can then be placed in specific skills training modules to upgrade to the needed levels, or placed in positions that better match their current skills.

Work Keys has been successfully utilized nationwide by numerous organizations. Two examples, again provided by the Work Keys website, www.act.org/workkeys, show the variety of ways in which Work Keys works.

1. **Work Ready in Des Moines, Iowa**, provides adults who are under-prepared for work—lacking experience, academic training, or credentials— with guidance and a well-planned path to establish a new cycle of learning, improving and increasing independence. The approach involves four steps: 1) Initial Work Keys testing during Work Ready orientation 2) A two-week career exploration and job-seeking skills course using Work Keys scores and other information to develop short-term and long-term plans 3) A six-week, 120-hour curriculum designed to build the skills required for workplace success 4) A second Work Keys assessment at the end of the program.

The results? 85% of participants improved their skills, 80 percent of first-year participants are now either in college or employed in better-than-minimum-wage jobs and behavioral changes such as greater punctuality, appreciation for learning, and independence have been documented in the individuals that participated in the Work Ready process.

2. The **Wichita, Kansas aerospace cluster** used Work Keys as the vehicle for cooperation between business and education when Wichita’s aerospace cluster saw a growing need to hire people with increasingly complex skills. Rather than import people or export jobs, the cluster decided to work with the city, schools and internally amongst the companies themselves, to expand the local skilled workforce.

In 1994, the Business Education Success Team funded Work Keys as a driving force for educational reform in public and private schools. Meanwhile, Wichita employers

and the Wichita Area Technical College began profiling crucial blue- and white-collar jobs in the aerospace industry. Wichita State University also began Work Keys testing for engineering seniors. In the fall of 1996, Wichita became the first school district in the country to make Work Keys testing a graduation requirement.

The results include:

- a curriculum that's better aligned with the needs of local employers, particularly in the high-wage aerospace sector
- a 100-page booklet entitled "Keys to Working in Wichita" which compares profiles of popular jobs in the cluster with students' current skill levels
- a systematic flow of hard data to measure progress in teaching job-relevant skills

The Regional Community Audit Partnership, working with MetroVision's clusters, represents the perfect vehicle for implementation of Work Keys throughout the region. Profilers and Assessors can be certified through ACT's Work Keys training program relatively inexpensively and the program is inexpensive to administer in comparison with other workforce investments. Work Keys, working through MetroVision's cluster committees, can provide the framework for dramatic and near-immediate change in the entire workforce skills system.

7. Work to increase integration of workforce development services provided by other mandatory Workforce Investment Act Partner agencies. The One Stop agencies and the Workforce Investment Boards should work to coordinate with partner agencies such as TANF, the Louisiana Department of Labor, and Louisiana Vocational Rehabilitation Services. This will facilitate the provision of more streamlined access to services to companies, as well as individual job seekers so that the myriad of these services will be available in one centralized location, thus reducing duplication of efforts and confusion on the part of the client as to which agency does what and where.

Measurements of Success

How will we know that these action steps are working? One way to monitor results is to compile as much feedback as possible from regional employers to determine if job applicants are exhibiting higher levels of Life Skills, New Basic Skills, and the ability to carry out the skilled tasks involved in performing their jobs. The primary quantitative method that can be utilized to measure success is to measure the changes in the poverty rate. One of the functions of workforce development is poverty fighting. At the present, Louisiana has the highest poverty rate in the nation at 20.3 percent.

Although this report focuses on the regional economy, the Greater New Orleans region is a large enough population center to influence statewide statistics. Once implemented, a key element in measuring the success of the recommendations will be a reduction of the statewide poverty rate by 100 basis points, or 1 percent annually for the next five years.

Another key measurement of success will be an increase in the location quotient for information technology jobs in the Greater New Orleans region. At the present time, this quantitative measure indicates that firms located outside of the region hold 42 percent of the jobs needed to support the information technology demands of the Greater New Orleans region.

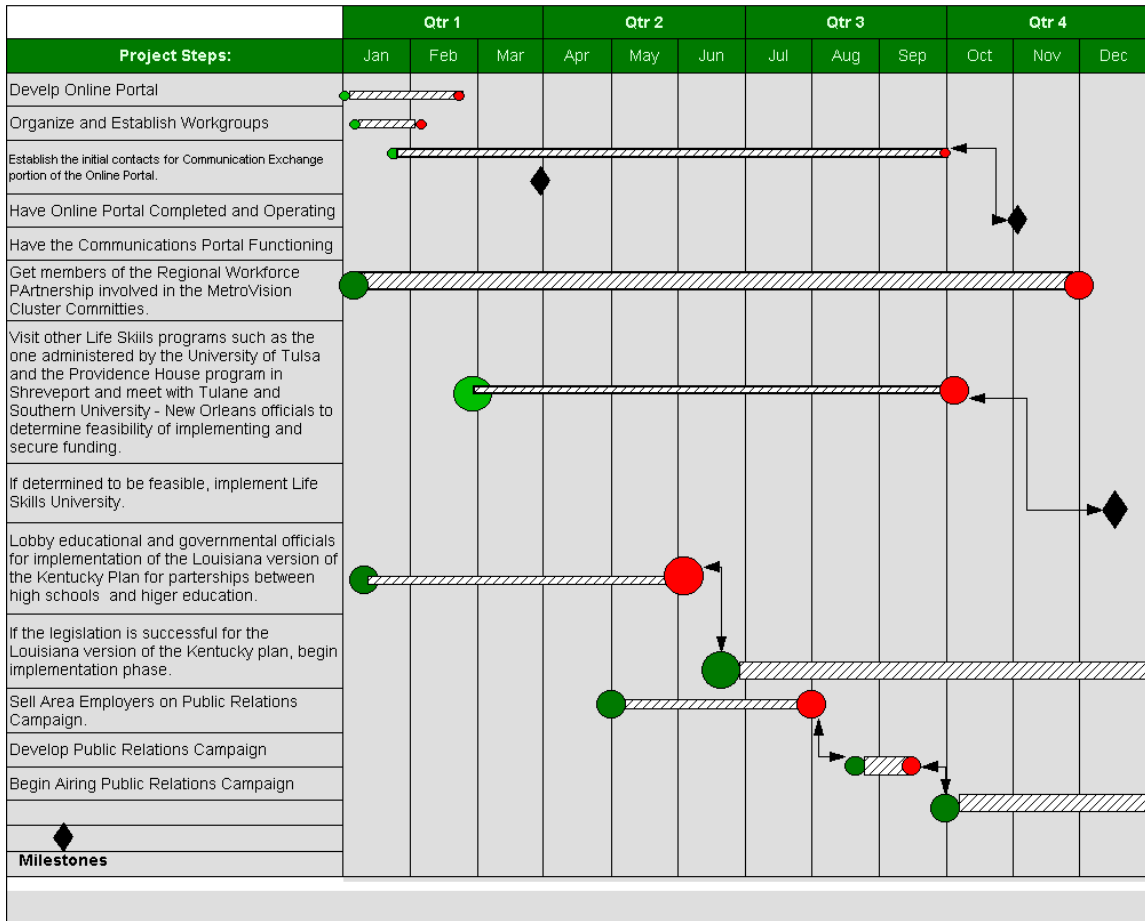
Implementation Guide

The following implementation guide provides a framework for implementing the recommendations in this report. It includes a set of action steps to follow as a guide, a timeframe, and a preliminary budget. The progress of these recommendations will depend on the ability of all stakeholders to support it with commitments of time and resources.

Action Steps

1. **Organize Working Groups:** For each of the strategies detailed above, organize a working group that will initially function on an ad-hoc basis, but that may convert to permanent status if appropriate. Each group should include representatives of the Regional Community Audit Partnership, leaders of the MetroVision clusters, administrative as well as placement officials of learning institutions, leaders and supporters of organizations that work with at risk youth that may consider dropping out of school, and public officials directly responsible for education.
2. **Develop Initial Working Group Mission:** A concise statement of purpose that, when fulfilled, will accomplish implementation of the strategy.
3. **Develop Initial Milestones:** The specific recommendations should be broken down into action items. Each action item should be assigned a timeframe for completion.
4. **Develop Metrics:** Each action item should be assigned a metric to measure progress and success. For example, development of a request for proposals for an interactive communications system should be converted to “receive a minimum of four proposals for the creation of an interactive system by 03/01/03.”
5. **Develop reporting guidelines:** Each Working Group should develop reporting guidelines to measure progress, and should schedule regular progress report updates individually and with the entirety of the Partnership. The working groups should develop a master schedule to use in reporting back to the Regional Community Audit Partnership.

Timeline for Implementing Recommendations (2003)



Summary

The challenges presented in this demand assessment are daunting. We are essentially faced with starting at the ground level and motivating a group of young people who are more likely than their national counterparts to live in poverty, have a bleak outlook on life and be enrolled in a public education system that is performing at a sub-sufficient level in preparing, motivating and educating them to the point that they can become contributing members of society. We cannot expect employers to expand within or locate to the Greater New Orleans region if they have to pay for education twice (once through taxes and yet again through on the job training to teach employees both technical and soft skills). However, there is a core group of committed individuals representing all stakeholders which is willing to work to meet this challenge.

Looking forward, our best hopes for the successful development of the Greater New Orleans Region's workforce must rest in stories such as that of Sonia Rodriguez, who participated in the Northrop Grumman Ship System's On The Job Training and Employment Program, known internally within Northrop Grumman Ship Systems as Pay-for-Skills. Sonia, who had been a housewife for 20 years, decided to enter the workforce and has now risen to the position of ship fitter apprentice. Commenting on her

return to the workforce mainstream, she stated “I always told myself I would do something for me....I’ve never done anything like this before.” I like everything I’m doing in the training program. It’s exciting to have a new challenge. Now, I’m looking forward to working out in the field.”

Looking forward, in aligning our regional labor supply and demand, in matching employees who have the skills for the job, or the hunger to learn them, with our area employers, we must hope that there are many more individuals like Sonia within our region. We must rely on the premise that there are people who truly want to become productive contributors to our community, people who are motivated by new challenges, and look forward to increasing their capabilities and adhering to a defined career track that will move them up within the ranks. It’s our task to provide the framework for them to succeed.

Making Connections:
A Regional Workforce

Demand Audit

Appendixes A – H

Career Guide:

Skills Needed and Career Pathways for In-Demand Jobs in the Region

Appendix A

Maritime and Shipbuilding

Critical Positions for the Cluster and Region to Prosper

Industry: Maritime and Shipbuilding

Job Needed: Millwright

Nature of the Work

Millwrights must use their athletic abilities. Eye-hand coordination, manual dexterity and physical balance are also important. The nature of their work requires millwrights to use a large number of personal tools. They require one set of tools for heavy work and a different set for precision work. Millwrights install, repair, replace, and dismantle the machinery and heavy equipment used in almost every industry. They may be responsible for placement and installation of machines in a plant or shop. They use hoists, pulleys, jacks, and come-a-longs to perform tasks. Other tools used vary from carpentry to masonry to mechanical trade hand tools such as micrometers and calipers. They also use power tools and laser levels.

Millwright skills range from interpreting drawings and performing layout, to rigging, assembling and machining parts until they are in perfect working order. It is not unusual for a crew of millwrights to be involved in heavy physical work in the morning and fine precision work in the afternoon.

Millwrights fit bearings, align gears and wheels, attach motors, and connect belts according to manufacturer's specifications. They may be in charge of preventative maintenance such as lubrication and fixing or replacing worn parts. Precision leveling and alignment are important in the assembly process; millwrights must have good mathematical skills so they can measure angles, material thickness, and small distances. Often they build the foundation that equipment may rest on. Millwrights employed in manufacturing typically work in a shop setting and use protective equipment to avoid common hazards.

Training, Other Qualifications, and Advancement

Most industrial machinery installation, repair, and maintenance workers, including millwrights, learn their trade through a 4-year apprenticeship program combining classroom instruction with on-the-job-training. These programs usually are sponsored by a local trade union. Other machinery maintenance workers start as helpers and pick up the skills of the trade informally and by taking courses offered by machinery manufacturers and community colleges.

Trainee repairers learn from experienced repairers how to operate, disassemble, repair, and assemble machinery. Trainees also may work with concrete and receive instruction in related skills, such as carpentry, welding, and sheet metal work. Classroom instruction focuses on subjects such as shop mathematics, blueprint reading, welding, electronics, and computer training.

Most employers prefer to hire those who have completed high school or its equivalency, and who have some vocational training or experience. High school courses in mechanical drawing, mathematics, blueprint reading, physics, computers, and electronics are especially useful. Mechanical aptitude and manual dexterity are important characteristics for workers in this trade. Good physical conditioning and agility also are necessary because repairers sometimes have to lift heavy objects or climb to reach equipment located high above the floor. Opportunities for advancement include jobs as estimator, distribution manager, inspector, project manager, trade instructor, foreman, and more. Many millwrights have also started their own businesses.

Industry: Maritime and Shipbuilding

Job Needed: Pipefitter

Nature of the Work

Pipefitters install and repair high- and low- pressure pipe systems used in manufacturing, in generation of electricity, and in heating and cooling buildings. Specialization includes steamfitters who install pipe systems to move liquids or gases under high pressure and sprinklerfitters who install automatic fire sprinkler systems in buildings. Steamfitters/pipefitters use a variety of skills when installing pipe systems. For example, they bend pipe and make welded, brazed soldered or threaded joints. After a pipe is installed, the steamfitter-pipefitter tests for leaks by filling the pipes with liquid or gas under pressure. They also install automatic controls that are increasingly being used to regulate these systems.

Pipefitters work from blueprints or drawing. They layout the job and perform such tasks as measuring, marking, cutting and threading pipe to connect pipe systems. Pipefitters work with various piping materials and tools and must know the specific use of each. For example, gas and other chemicals require certain types of pipes and different types of seals and gaskets. Different pipes require different tools for assembly. The pipe fitter's trade requires formal training to know local ordinances, state codes and regulations regarding their work. Pipefitters work both outdoors and indoors, usually in teams. Physical strength is needed to lift pipes, fittings, and heavy duty wrenches. Pipefitters must use their athletic capabilities.

Training, Other Qualifications, and Advancement

Virtually all pipefitters and steamfitters undergo some type of apprenticeship training. Many programs are administered by local union-management committees made up of members of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada, and local employers who are members of the Mechanical Contractors Association of America, the National

Association of Plumbing-Heating-Cooling Contractors, or the National Fire Sprinkler Association.

Nonunion training and apprenticeship programs are administered by local chapters of the Associated Builders and Contractors, the National Association of Plumbing-Heating-Cooling Contractors, the American Fire Sprinkler Association, or the Home Builders Institute of the National Association of Home Builders.

Apprenticeships—both union and nonunion—consist of 4 or 5 years of on-the-job training, in addition to at least 144 hours per year of related classroom instruction. Classroom subjects include drafting and blueprint reading, mathematics, applied physics and chemistry, safety, and local plumbing codes and regulations. On the job, apprentices first learn basic skills, such as identifying grades and types of pipe, using the tools of the trade, and safely unloading materials. As apprentices gain experience, they learn how to work with various types of pipe and how to install different piping systems and plumbing fixtures. Apprenticeship gives trainees a thorough knowledge of all aspects of the trade. Although most pipelayers, plumbers, pipefitters, and steamfitters are trained through apprenticeship, some still learn their skills informally on the job.

Applicants for union or nonunion apprentice jobs must be at least 18 years old and in good physical condition. Apprenticeship committees may require applicants to have a high school diploma or its equivalent. Armed Forces training in pipelaying, plumbing, and pipefitting is considered very good preparation. In fact, persons with this background may be given credit for previous experience when entering a civilian apprenticeship program. Secondary or postsecondary courses in shop, plumbing, general mathematics, drafting, blueprint reading, computers, and physics also are good preparation.

Industry: Maritime and Shipbuilding

Job Needed: Machinist

Nature of the Work

Machinists use machine tools, such as lathes, milling machines, and spindles, to produce precision metal parts. Although they may produce large quantities of one part, precision machinists often produce small batches or one-of-a-kind items. They use their knowledge of the working properties of metals and their skill with machine tools to plan and carry out the operations needed to make machined products that meet precise specifications.

Before they machine a part, machinists must carefully plan and prepare the operation. These workers first review blueprints or written specifications for a job. Next, they calculate where to cut or bore into the workpiece (the piece of metal that is being shaped), how fast to feed the metal into the machine, and how much metal to remove.

They then select tools and materials for the job, plan the sequence of cutting and finishing operations, and mark the metal stock to show where cuts should be made.

After this layout work is completed, machinists perform the necessary machining operations. They position the metal stock on the machine tool—spindle, drill press, lathe, milling machine, or other—set the controls, and make the cuts. During the machining process, they must constantly monitor the feed and speed of the machine. Machinists also ensure that the work piece is being properly lubricated and cooled, because the machining of metal products generates a significant amount of heat. The temperature of the work piece is a key concern because most metals expand when heated; machinists must adjust the size of their cuts relative to the temperature. Some rarer, but increasingly popular, metals, such as titanium, are machined at extremely high temperatures. Machinists also adjust cutting speeds to compensate for harmonic vibrations, which can decrease the accuracy of cuts, particularly on newer high-speed spindles and lathes.

Training, Other Qualifications, and Advancement

Machinists train in apprenticeship programs, informally on the job, and in high schools, vocational schools, or community or technical colleges. In fact, many entrants previously have worked as machine setters, operators, or tenders.

Persons interested in becoming machinists should be mechanically inclined, able to work independently, and able to do highly accurate work that requires concentration and physical effort. High school or vocational school courses in mathematics, blueprint reading, metalworking, and drafting are highly recommended. Apprenticeship programs consist of shop training and related classroom instruction. In shop training, apprentices work almost full time, and are supervised by an experienced machinist while learning to operate various machine tools. Classroom instruction includes math, physics, blueprint reading, mechanical drawing, and quality and safety practices. In addition, as machine shops have increased their use of computer-controlled equipment, training in the operation and programming of CNC machine tools has become essential. Apprenticeship classes are taught in cooperation with local community or vocational colleges. A growing number of machinists learn the trade through 2-year associate degree programs at community or technical colleges. Graduates of these programs still need significant on-the-job experience before they are fully qualified.

To boost the skill level of machinists and to create a more uniform standard of competency, a number of training facilities and colleges have recently begun implementing curriculums incorporating national skills standards developed by the National Institute of Metalworking Skills (NIMS). After completing such a curriculum and passing a performance requirement and written exam, a NIMS credential is granted to trainees, providing formal recognition of competency in a metalworking field. Completing a recognized certification program provides a machinist with better career opportunities.

As new automation is introduced, machinists normally receive additional training to update their skills. This training usually is provided by a representative of the equipment manufacturer or a local technical school. Some employers offer tuition reimbursement for job-related courses. Machinists can advance in several ways. Experienced machinists may become computer-control programmers and operators, and some are promoted to supervisory or administrative positions in their firms. A few open their own shops.

Industry: Maritime and Shipbuilding

Job Needed: Mechanic

Nature of the Work

Maintenance mechanics must be able to detect and diagnose minor problems and correct them before they become major ones. For example, after hearing a vibration from a machine, the mechanic must decide whether it is due to worn belts, weak motor bearings, or some other problem. Computerized maintenance, vibration analysis techniques, and self-diagnostic systems are making this task easier. Self-diagnostic features on new industrial machinery can determine the cause of a malfunction and, in some cases, alert the mechanic to potential trouble spots before symptoms develop.

After diagnosing the problem, the mechanic disassembles the equipment and repairs or replaces the necessary parts. Once the machine is reassembled, the final step is to test it to ensure that it is running smoothly. When repairing electronically controlled machinery, maintenance mechanics may work closely with electronic repairers or electricians who maintain the machine's electronic parts. However, industrial machinery installation, repair, and maintenance workers increasingly need electronic and computer skills to repair sophisticated equipment on their own.

Although repairing machines is the most important job of industrial machinery installation, repair, and maintenance workers, they also perform preventive maintenance. This includes keeping machines and their parts well oiled, greased, and cleaned. Repairers regularly inspect machinery and check performance. For example, they adjust and calibrate automated manufacturing equipment such as industrial robots, and rebuild components of other industrial machinery. By keeping complete and up-to-date records, mechanics try to anticipate trouble and service equipment before factory production is interrupted.

Training, Other Qualifications, and Advancement

Although many persons qualify for service technician jobs through years of on-the-job training, most employers prefer that applicants complete a formal diesel or heavy equipment mechanic training program after graduating from high school. They seek

persons with mechanical aptitude who are knowledgeable about the fundamentals of diesel engines, transmissions, electrical systems, and hydraulics. Additionally, the constant change in equipment technology makes it necessary for technicians to be flexible and have the capacity to learn new skills quickly.

Many community colleges and vocational schools offer programs in diesel technology. Some tailor programs to heavy equipment mechanics. These programs educate the student in the basics of analysis and diagnostic techniques, electronics, and hydraulics. The increased use of electronics and computers makes training in the fundamentals of electronics essential for new heavy and mobile equipment mechanics. Some 1- to 2-year programs lead to a certificate of completion, whereas others lead to an associate degree in diesel or heavy equipment mechanics. These programs provide a foundation in the components of diesel and heavy equipment technology. These programs also enable trainee technicians to advance more rapidly to the journey, or experienced worker, level.

A combination of formal and on-the-job training prepares trainee technicians with the knowledge to efficiently service and repair equipment handled by a shop. Most beginners perform routine service tasks and make minor repairs, after a few months' experience. They advance to harder jobs, as they prove their ability and competence. After trainees master the repair and service of diesel engines, they learn to work on related components, such as brakes, transmissions, and electrical systems. Generally, a service technician with at least 3 to 4 years of on-the-job experience is accepted as fully qualified.

Many employers send trainee technicians to training sessions conducted by heavy equipment manufacturers. These sessions, which typically last up to 1 week, provide intensive instruction in the repair of a manufacturer's equipment. Some sessions focus on particular components found in the manufacturer's equipment, such as diesel engines, transmissions, axles, and electrical systems. Other sessions focus on particular types of equipment, such as crawler-loaders and crawler-dozers. As they progress, trainees may periodically attend additional training sessions. When appropriate, experienced technicians attend training sessions to gain familiarity with new technology or equipment.

High school courses in automobile repair, physics, chemistry, and mathematics provide a strong foundation for a career as a service technician or mechanic. It is also essential for technicians to be able to read and interpret service manuals to keep abreast of engineering changes. Experience working on diesel engines and heavy equipment acquired in the Armed Forces also is valuable.

Voluntary certification by the National Institute for Automotive Service Excellence (ASE) is recognized as the standard of achievement for heavy and mobile equipment diesel service technicians. Technicians may be certified as a Master Heavy-Duty Diesel Technician or in 1 or more of 6 different areas of heavy-duty equipment repair: Brakes, gasoline engines, diesel engines, drive trains, electrical systems, and suspension and steering. For certification in each area, technicians must pass a written examination and have at least 2 years' experience. High school, vocational or trade school, or community or junior college training in gasoline or diesel engine repair may substitute for up to 1

year's experience. To remain certified, technicians must retest every 5 years. This ensures that service technicians keep up with changing technology. However, there are currently no certification programs for other heavy vehicle and mobile equipment repair specialties.

Experienced technicians may advance to field service jobs, where they have a greater opportunity to tackle problems independently and earn additional pay. Technicians with leadership ability may become shop supervisors or service managers. Some technicians open their own repair shops or invest in a franchise.

Appendix B

Healthcare/Life Sciences

Critical Positions for the Cluster and Region to Prosper

Industry: Healthcare/Life Sciences

Job Needed: Home Health Worker

Nature of the Work

Home health aides help elderly, convalescent, or disabled persons live in their own homes instead of in a health facility. Under the direction of nursing or medical staff, they provide health-related services, such as administering oral medications. Like nursing aides, home health aides may check pulse, temperature, and respiration; help with simple prescribed exercises; keep patients' rooms neat; and help patients move from bed, bathe, dress, and groom. Occasionally, they change non-sterile dressings, give massages and alcohol rubs, or assist with braces and artificial limbs. Experienced home health aides also may assist with medical equipment such as ventilators, which help patients breathe. Most home health aides work with elderly or disabled persons who need more extensive care than family or friends can provide. Some help discharged hospital patients who have relatively short-term needs.

In home healthcare agencies, a registered nurse, physical therapist, or social worker usually assigns specific duties and supervises home health aides. Aides keep records of services performed and patients' condition and progress. They report changes in patients' conditions to the supervisor or case manager.

Training, Other Qualifications, and Advancement

In many cases, neither a high school diploma nor previous work experience is necessary for a job as a nursing, psychiatric, or home health aide. A few employers, however, require some training or experience. Hospitals may require experience as a nursing aide or home health aide. Nursing homes often hire inexperienced workers who must complete a minimum of 75 hours of mandatory training and pass a competency evaluation program within 4 months of employment. Aides who complete the program are certified and placed on the State registry of nursing aides. Some States require psychiatric aides to complete a formal training program.

The Federal Government has enacted guidelines for home health aides whose employers receive reimbursement from Medicare. Federal law requires home health aides to pass a competency test covering 12 areas: Communication skills; documentation of patient status and care provided; reading and recording vital signs; basic infection control procedures; basic body functions; maintenance of a healthy environment; emergency procedures; physical, emotional, and developmental characteristics of patients; personal hygiene and grooming; safe transfer techniques; normal range of motion and positioning; and basic nutrition.

A home health aide may take training before taking the competency test. Federal law suggests at least 75 hours of classroom and practical training supervised by a registered nurse. Training and testing programs may be offered by the employing agency, but must

meet the standards of the Health Care Financing Administration. Training programs vary depending upon State regulations.

The National Association for Home Care offers national certification for home health aides. The certification is a voluntary demonstration that the individual has met industry standards.

Nursing aide training is offered in high schools, vocational-technical centers, some nursing homes, and some community colleges. Courses cover body mechanics, nutrition, anatomy and physiology, infection control, communication skills, and resident rights. Personal care skills such as how to help patients bathe, eat, and groom also are taught.

Some facilities, other than nursing homes, provide classroom instruction for newly hired aides, while others rely exclusively on informal on-the-job instruction from a licensed nurse or an experienced aide. Such training may last several days to a few months. From time to time, aides may also attend lectures, workshops, and in-service training.

These occupations can offer individuals an entry into the world of work. The flexibility of night and weekend hours also provides high school and college students a chance to work during the school year.

Applicants should be tactful, patient, understanding, healthy, emotionally stable, dependable, and have a desire to help people. They should also be able to work as part of a team, have good communication skills, and be willing to perform repetitive, routine tasks. Home health aides should be honest and discreet because they work in private homes. Aides must be in good health. A physical examination, including State regulated tests such as those for tuberculosis, may be required.

Opportunities for advancement within these occupations are limited. To enter other health occupations, aides generally need additional formal training. Some employers and unions provide opportunities by simplifying the educational paths to advancement. Experience as an aide can also help individuals decide whether to pursue a career in the healthcare field.

Industry: Healthcare/Life Sciences

Job Needed: Nurses

Nature of the Work

Registered nurses (RNs) work to promote health, prevent disease, and help patients cope with illness. They are advocates and health educators for patients, families, and communities. When providing direct patient care, they observe, assess, and record symptoms, reactions, and progress; assist physicians during treatments and examinations; administer medications; and assist in convalescence and rehabilitation. RNs also develop and manage nursing care plans; instruct patients and their families in proper care; and

help individuals and groups take steps to improve or maintain their health. While State laws govern the tasks that RNs may perform, it is usually the work setting that determines their daily job duties.

Hospital nurses form the largest group of nurses. Most are staff nurses, who provide bedside nursing care and carry out medical regimens. They also may supervise licensed practical nurses and nursing aides. Hospital nurses usually are assigned to one area, such as surgery, maternity, pediatrics, emergency room, intensive care, or treatment of cancer patients. Some may rotate among departments.

Office nurses care for outpatients in physicians' offices, clinics, surgicenters, and emergency medical centers. They prepare patients for and assist with examinations, administer injections and medications, dress wounds and incisions, assist with minor surgery, and maintain records. Some also perform routine laboratory and office work.

Nursing home nurses manage nursing care for residents with conditions ranging from a fracture to Alzheimer's disease. Although they often spend much of their time on administrative and supervisory tasks, RNs also assess residents' health condition, develop treatment plans, supervise licensed practical nurses and nursing aides, and perform difficult procedures such as starting intravenous fluids.

Occupational health or industrial nurses provide nursing care at worksites to employees, customers, and others with minor injuries and illnesses. They provide emergency care, prepare accident reports, and arrange for further care if necessary. They also offer health counseling, assist with health examinations and inoculations, and assess work environments to identify potential health or safety problems.

At the advanced level, *nurse practitioners* provide basic primary healthcare. They diagnose and treat common acute illnesses and injuries. Nurse practitioners also can prescribe medications but certification and licensing requirements vary by State. Other advanced practice nurses include *clinical nurse specialists*, *certified registered nurse anesthetists*, and *certified nurse-midwives*. Advanced practice nurses must meet higher educational and clinical practice requirements beyond the basic nursing education and licensing required of all RNs.

Training, Other Qualifications, and Advancement

In all States and the District of Columbia, students must graduate from an approved nursing program and pass a national licensing examination to obtain a nursing license. Nurses may be licensed in more than one State, either by examination, by endorsement of a license issued by another State, or through a multi-State licensing agreement. All States require periodic license renewal, which may involve continuing education.

There are three major educational paths to registered nursing: associate degree in nursing (A.D.N.), Bachelor of Science degree in nursing (B.S.N.), and diploma. A.D.N. programs, offered by community and junior colleges, take about 2 to 3 years. About half

of the 1,700 RN programs in 2000 were at the A.D.N. level. B.S.N. programs, offered by colleges and universities, take 4 or 5 years. More than one-third of all programs in 2000 offered degrees at the bachelor's level. Diploma programs, administered in hospitals, last 2 to 3 years. Only a small number of programs offer diploma-level degrees. Generally, licensed graduates of any of the three program types qualify for entry-level positions as staff nurses.

Many A.D.N. and diploma-educated nurses later enter bachelor's programs to prepare for a broader scope of nursing practice. They can often find a staff nurse position and then take advantage of tuition reimbursement programs to work toward a B.S.N.

Individuals considering nursing should carefully weigh the pros and cons of enrolling in a B.S.N. program because, if they do so, their advancement opportunities usually are broader. In fact, some career paths are open only to nurses with bachelor's or advanced degrees. A bachelor's degree is often necessary for administrative positions, and it is a prerequisite for admission to graduate nursing programs in research, consulting, teaching, or a clinical specialization.

Nursing education includes classroom instruction and supervised clinical experience in hospitals and other health facilities. Students take courses in anatomy, physiology, microbiology, chemistry, nutrition, psychology and other behavioral sciences, and nursing. Coursework also includes the liberal arts. Supervised clinical experience is provided in hospital departments such as pediatrics, psychiatry, maternity, and surgery. A growing number of programs include clinical experience in nursing homes, public health departments, home health agencies, and ambulatory clinics.

Nurses should be caring and sympathetic. They must be able to accept responsibility, direct or supervise others, follow orders precisely, and determine when consultation is required. Experience and good performance can lead to promotion to more responsible positions. Nurses can advance, in management, to assistant head nurse or head nurse. From there, they can advance to assistant director, director, and vice president. Increasingly, management-level nursing positions require a graduate degree in nursing or health services administration. They also require leadership, negotiation skills, and good judgment. Graduate programs preparing executive-level nurses usually last 1 to 2 years.

Within patient care, nurses can advance to clinical nurse specialist, nurse practitioner, certified nurse-midwife, or certified registered nurse anesthetist. These positions require 1 or 2 years of graduate education, leading to a master's degree or, in some instances, to a certificate.

Some nurses move into the business side of healthcare. Their nursing expertise and experience on a healthcare team equip them to manage ambulatory, acute, home health, and chronic care services. Healthcare corporations employ nurses for health planning and development, marketing, and quality assurance. Other nurses work as college and university faculty or do research.

Industry: Healthcare/Life Sciences

Job Needed: Medical Records Tech

Nature of the Work

Every time health care personnel treat a patient, they record what they observed, and how the patient was treated medically. This record includes information the patient provides concerning their symptoms and medical history, the results of examinations, reports of x-rays and laboratory tests, diagnoses, and treatment plans. Medical records and health information technicians organize and evaluate these records for completeness and accuracy.

Medical records and health information technicians begin to assemble patients' health information by first making sure their initial medical charts are complete. They ensure all forms are completed and properly identified and signed, and all necessary information is in the computer. Sometimes, they communicate with physicians or others to clarify diagnoses or get additional information.

Technicians assign a code to each diagnosis and procedure. They consult classification manuals and rely, also, on their knowledge of disease processes. Technicians then use a software program to assign the patient to one of several hundred "diagnosis-related groups," or DRG's. The DRG determines the amount the hospital will be reimbursed if the patient is covered by Medicare or other insurance programs using the DRG system. Technicians who specialize in coding are called health information coders, medical record coders, coder/abstractors, or coding specialists. In addition to the DRG system, coders use other coding systems, such as those geared towards ambulatory settings.

Technicians also use computer programs to tabulate and analyze data to help improve patient care, control costs, for use in legal actions, in response to surveys, or for use in research studies. *Tumor registrars* compile and maintain records of patients who have cancer to provide information to physicians and for research studies.

Medical records and health information technicians' duties vary with the size of the facility. In large to medium facilities, technicians may specialize in one aspect of health information, or supervise health information clerks and transcriptionists while a *medical records and health information administrator* manages the department. In small facilities, a credentialed medical records and health information technician sometimes manages the department.

Training, Other Qualifications, and Advancement

Medical records and health information technicians entering the field usually have an associate degree from a community or junior college. In addition to general education, coursework includes medical terminology, anatomy and physiology, legal aspects of health information, coding and abstraction of data, statistics, database management, quality improvement methods, and computer training. Applicants can improve their chances of admission into a program by taking biology, chemistry, health, and computer courses in high school.

Hospitals sometimes advance promising health information clerks to jobs as medical records and health information technicians, although this practice may be less common in the future. Advancement usually requires 2 to 4 years of job experience and completion of a hospital's in-house training program.

Most employers prefer to hire Registered Health Information Technicians (RHIT), who must pass a written examination offered by AHIMA. To take the examination, a person must graduate from a 2-year associate degree program accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP) of the American Medical Association. Technicians trained in non-CAAHEP accredited programs, or on the job, are not eligible to take the examination. In 2001, CAAHEP accredited 177 programs for health information technicians. Technicians who specialize in coding may also obtain voluntary certification.

Experienced medical records and health information technicians usually advance in one of two ways—by specializing or managing. Many senior technicians specialize in coding, particularly Medicare coding, or in tumor registry.

In large medical records and health information departments, experienced technicians may advance to section supervisor, overseeing the work of the coding, correspondence, or discharge sections, for example. Senior technicians with RHIT credentials may become director or assistant director of a medical records and health information department in a small facility. However, in larger institutions, the director is usually an administrator, with a bachelor's degree in medical records and health information administration.

Industry: Healthcare/Life Sciences

Job Needed: Physician's Assistant

Nature of the Work

Physician assistants (PAs) provide healthcare services under the supervision of physicians. They should not be confused with medical assistants, who perform routine clinical and clerical tasks. PAs are formally trained to provide diagnostic, therapeutic, and preventive healthcare services, as delegated by a physician. Working as members of the healthcare team, they take medical histories, examine and treat patients, order and interpret laboratory tests and x rays, make diagnoses, and prescribe medications. They also treat minor injuries by suturing, splinting, and casting. PAs record progress notes, instruct and counsel patients, and order or carry out therapy. In 47 States and the District of Columbia, physician assistants may prescribe medications. PAs also may have managerial duties. Some order medical and laboratory supplies and equipment and may supervise technicians and assistants.

Physician assistants work under the supervision of a physician. However, PAs may be the principal care providers in rural or inner city clinics, where a physician is present for only 1 or 2 days each week. In such cases, the PA confers with the supervising physician and other medical professionals as needed or as required by law. PAs also may make house calls or go to hospitals and nursing homes to check on patients and report back to the physician.

The duties of physician assistants are determined by the supervising physician and by State law. Aspiring PAs should investigate the laws and regulations in the States in which they wish to practice.

Many PAs work in primary care areas such as general internal medicine, pediatrics, and family medicine. Others work in specialty areas, such as general and thoracic surgery, emergency medicine, orthopedics, and geriatrics. PAs specializing in surgery provide pre- and postoperative care, and may work as first or second assistants during major surgery.

Training, Other Qualifications, and Advancement

All States require that new PAs complete an accredited, formal education program. As of July 2001, there were 129 accredited or provisionally accredited educational programs for physician assistants; 64 of these programs offered a master's degree. The rest offered either a bachelor's degree or an associate degree. Most PA graduates have at least a bachelor's degree.

Admission requirements vary, but many programs require 2 years of college and some work experience in the healthcare field. Students should take courses in biology, English,

chemistry, math, psychology, and social sciences. More than two-thirds of all applicants hold a bachelor's or master's degree. Many applicants are former emergency medical technicians, other allied health professionals, or nurses.

PA programs usually last at least 2 years. Most programs are in schools of allied health, academic health centers, medical schools, or 4-year colleges; a few are in community colleges, the military, or hospitals. Many accredited PA programs have clinical teaching affiliations with medical schools.

PA education includes classroom instruction in biochemistry, pathology, human anatomy, physiology, microbiology, clinical pharmacology, clinical medicine, geriatric and home healthcare, disease prevention, and medical ethics. Students obtain supervised clinical training in several areas, including primary care medicine, inpatient medicine, surgery, obstetrics and gynecology, geriatrics, emergency medicine, psychiatry, and pediatrics. Sometimes, PA students serve one or more of these "rotations" under the supervision of a physician who is seeking to hire a PA. These rotations often lead to permanent employment.

All States and the District of Columbia have legislation governing the qualifications or practice of physician assistants. All jurisdictions require physician assistants to pass the Physician Assistants National Certifying Examination, administered by the National Commission on Certification of Physician Assistants (NCCPA)—open to graduates of accredited PA educational programs. Only those successfully completing the examination may use the credential "Physician Assistant-Certified (PA-C)." In order to remain certified, PAs must complete 100 hours of continuing medical education every 2 years. Every 6 years, they must pass a re-certification examination or complete an alternate program combining learning experiences and a take-home examination.

Some PA's pursue additional education in a specialty area such as surgery, neonatology, or emergency medicine. PA postgraduate residency training programs are available in areas such as internal medicine, rural primary care, emergency medicine, surgery, pediatrics, neonatology, and occupational medicine. Candidates must be graduates of an accredited program and be certified by the NCCPA.

Physician assistants need leadership skills, self-confidence, and emotional stability. They must be willing to continue studying throughout their career to keep up with medical advances. As they attain greater clinical knowledge and experience, PAs can advance to added responsibilities and higher earnings. However, by the very nature of the profession, clinically practicing PAs always are supervised by physicians.

Appendix C

Information Technology / E-Commerce

Critical Positions for the Cluster and Region to Prosper

Industry: I.T./E-Commerce

Job Needed: Computer Programmers

Nature of the Work

Computer programmers write, test, and maintain the detailed instructions, called programs, that computers must follow to perform their functions. They also conceive, design, and test logical structures for solving problems by computer. Many technical innovations in programming—advanced computing technologies and sophisticated new languages and programming tools—have redefined the role of a programmer and elevated much of the programming work done today. Job titles and descriptions may vary, depending on the organization. In this occupational statement, *computer programmer* refers to individuals whose main job function is programming; this group has a wide range of responsibilities and educational backgrounds.

Computer programs tell the computer what to do, such as which information to identify and access, how to process it, and what equipment to use. Programs vary widely depending upon the type of information to be accessed or generated. For example, the instructions involved in updating financial records are very different from those required to duplicate conditions on board an aircraft for pilots training in a flight simulator. Although simple programs can be written in a few hours, programs that use complex mathematical formulas, whose solutions can only be approximated, or that draw data from many existing systems, may require more than a year of work. In most cases, several programmers work together as a team under a senior programmer's supervision. Programmers write programs according to the specifications determined primarily by computer software engineers and system analysts.

Programmers often are grouped into two broad types—applications programmers and systems programmers. *Applications programmers* write programs to handle a specific job, such as a program to track inventory, within an organization. They may also revise existing packaged software. *Systems programmers*, on the other hand, write programs to maintain and control computer systems software, such as operating systems, networked systems, and database systems. These workers make changes in the sets of instructions that determine how the network, workstations, and central processing unit of the system handle the various jobs they have been given and how they communicate with peripheral equipment, such as terminals, printers, and disk drives. Because of their knowledge of the entire computer system, systems programmers often help applications programmers determine the source of problems that may occur with their programs.

Programmers in software development companies may work directly with experts from various fields to create software—either programs designed for specific clients or packaged software for general use—ranging from games and educational software to programs for desktop publishing, financial planning, and spreadsheets. Much of this type

of programming is in the preparation of packaged software, which comprises one of the most rapidly growing segments of the computer services industry.

Training, Other Qualifications, and Advancement

While there are many training paths available for programmers, mainly because employers' needs are so varied, the level of education and experience employers seek has been rising, due to the growing number of qualified applicants and the specialization involved with most programming tasks. Bachelor's degrees are commonly required, although some programmers may qualify for certain jobs with 2-year degrees or certificates. Employers are primarily interested in programming knowledge, and computer programmers are able to get certified in a language such as C++ or Java. College graduates who are interested in changing careers or developing an area of expertise also may return to a 2-year community college or technical school for additional training. In the absence of a degree, substantial specialized experience or expertise may be needed. Even with a degree, employers appear to be placing more emphasis on previous experience, for all types of programmers.

<i>Level</i>	<i>Percent</i>
High school graduate or equivalent or less	11.8
Some college, no degree	17.2
Associate degree	11.0
Bachelor's degree	47.4
Graduate degree	12.8

About 3 out of 5 computer programmers had a bachelor's degree or higher in 2000 (table 1). Of these, some hold a degree in computer science, mathematics, or information systems, whereas others have taken special courses in computer programming to supplement their study in fields such as accounting, inventory control, or other areas of business. As the level of education and training required by employers continues to rise, this proportion should increase in the future.

Required skills vary from job to job, but the demand for various skills generally is driven by changes in technology. Employers using computers for scientific or engineering applications usually prefer college graduates who have degrees in computer or information science, mathematics, engineering, or the physical sciences. Graduate degrees in related fields are required for some jobs. Employers who use computers for business applications prefer to hire people who have had college courses in management information systems (MIS) and business and who possess strong programming skills. Although knowledge of traditional languages still is important, increasing emphasis is placed on newer, object-oriented programming languages and tools, such as C++ and Java. Additionally, employers are seeking persons familiar with fourth and fifth

generation languages that involve graphic user interface (GUI) and systems programming. Employers also prefer applicants who have general business skills and experience related to the operations of the firm. Students can improve their employment prospects by participating in a college work-study program or by undertaking an internship.

Most systems programmers hold a 4-year degree in computer science. Extensive knowledge of a variety of operating systems is essential. This includes being able to configure an operating system to work with different types of hardware and adapting the operating system to best meet the needs of a particular organization. Systems programmers also must be able to work with database systems, such as DB2, Oracle, or Sybase, for example.

When hiring programmers, employers look for people with the necessary programming skills who can think logically and pay close attention to detail. The job calls for patience, persistence, and the ability to work on exacting analytical work, especially under pressure. Ingenuity and imagination also are particularly important, when programmers design solutions and test their work for potential failures. The ability to work with abstract concepts and to do technical analysis is especially important for systems programmers, because they work with the software that controls the computer's operation. Because programmers are expected to work in teams and interact directly with users, employers want programmers who are able to communicate with non-technical personnel.

Entry-level or junior programmers may work alone on simple assignments after some initial instruction or on a team with more experienced programmers. Either way, beginning programmers generally must work under close supervision. Because technology changes so rapidly, programmers must continuously update their training by taking courses sponsored by their employer or software vendors.

For skilled workers who keep up to date with the latest technology, the prospects for advancement are good. In large organizations, programmers may be promoted to lead programmer and be given supervisory responsibilities. Some applications programmers may move into systems programming after they gain experience and take courses in systems software. With general business experience, programmers may become programmer analysts or systems analysts or be promoted to a managerial position. Other programmers, with specialized knowledge and experience with a language or operating system, may work in research and development areas, such as multimedia or Internet technology. As employers increasingly contract out programming jobs, more opportunities should arise for experienced programmers with expertise in a specific area to work as consultants.

Technical or professional certification is a way to demonstrate a level of competency or quality. In addition to language-specific certificates that a programmer can obtain, product vendors or software firms also offer certification and may require professionals who work with their products to be certified. Voluntary certification also is available

through other organizations. Professional certification may provide a job seeker a competitive advantage.

Industry: I.T./E-Commerce

Job Needed: Systems Analysts

Nature of the Work

Systems analysts solve computer problems and enable computer technology to meet individual needs of an organization. They help an organization realize the maximum benefit from its investment in equipment, personnel, and business processes. This process may include planning and developing new computer systems or devising ways to apply existing systems' resources to additional operations. Systems analysts may design new systems, including both hardware and software, or add a new software application to harness more of the computer's power. Most systems analysts work with a specific type of system that varies with the type of organization they work for—for example, business, accounting, or financial systems, or scientific and engineering systems. Some systems analysts also are referred to as *systems developers* or *systems architects*.

Analysts begin an assignment by discussing the systems problem with managers and users to determine its exact nature. They define the goals of the system and divide the solutions into individual steps and separate procedures. Analysts use techniques such as structured analysis, data modeling, information engineering, mathematical model building, sampling, and cost accounting to plan the system. They specify the inputs to be accessed by the system, design the processing steps, and format the output to meet the users' needs. They also may prepare cost-benefit and return-on-investment analyses to help management decide whether implementing the proposed system will be financially feasible.

When a system is accepted, analysts determine what computer hardware and software will be needed to set it up. They coordinate tests and observe initial use of the system to ensure it performs as planned. They prepare specifications, work diagrams, and structure charts for computer programmers to follow and then work with them to "debug," or eliminate errors from, the system. Analysts, who do more in-depth testing of products, may be referred to as *software quality assurance analysts*. In addition to running tests, these individuals diagnose problems, recommend solutions, and determine if program requirements have been met.

In some organizations, *programmer-analysts* design and update the software that runs a computer. Because they are responsible for both programming and systems analysis, these workers must be proficient in both areas. As this becomes more commonplace,

these analysts increasingly work with object-oriented programming languages, as well as client/server applications development, and multimedia and Internet technology.

One obstacle associated with expanding computer use is the need for different computer systems to communicate with each other. Because of the importance of maintaining up-to-date information-accounting records, sales figures, or budget projections, for example, systems analysts work on making the computer systems within an organization compatible so that information can be shared. Many systems analysts are involved with "networking," connecting all the computers internally-in an individual office, department, or establishment-or externally, because many organizations now rely on e-mail or the Internet.

Training, Other Qualifications, and Advancement

Rapidly changing technology means an increasing level of skill and education demanded by employers. Companies are looking for professionals with a broader background and range of skills, including not only technical knowledge, but also communication and other interpersonal skills. This shift from requiring workers to possess solely sound technical knowledge emphasizes workers who can handle various responsibilities. While there is no universally accepted way to prepare for a job as a systems analyst, computer scientist, or database administrator, most employers place a premium on some formal college education. A bachelor's degree is a prerequisite for many jobs; however, some jobs may require only a 2-year degree. Relevant work experience also is very important. For more technically complex jobs, persons with graduate degrees are preferred.

For systems analyst, programmer-analyst, as well as database administrator positions, many employers seek applicants who have a bachelor's degree in computer science, information science, or management information systems (MIS). MIS programs usually are part of the business school or college. These programs differ considerably from computer science programs, emphasizing business and management-oriented coursework and business computing courses. Many employers increasingly seek individuals with a master's degree in business administration (MBA) with a concentration in information systems, as more firms move their business to the Internet. For some networks systems and data communication analysts, such as webmasters, an associate degree or certificate generally is sufficient, although more advanced positions might require a computer-related bachelor's degree. For computer and information scientists, a doctoral degree generally is required due to the highly technical nature of their work.

Despite the preference towards technical degrees, persons with degrees in a variety of majors find employment in these computer occupations. The level of education and type of training employers require depend on their needs. One factor affecting these needs is changes in technology. As demonstrated by the current demand for workers with skills related to the Internet, employers often scramble to find workers capable of implementing "hot" new technologies. Another factor driving employers' needs is the time frame in which a project must be completed.

Most community colleges and many independent technical institutes and proprietary schools offer an associate degree in computer science or a related information technology field. Many of these programs may be more geared toward meeting the needs of local businesses and are more occupation-specific than those designed for a 4-year degree. Some jobs may be better suited to the level of training these programs offer. Employers usually look for people who have broad knowledge and experience related to computer systems and technologies, strong problem-solving and analytical skills, and good interpersonal skills. Courses in computer science or systems design offer good preparation for a job in these computer occupations. For jobs in a business environment, employers usually want systems analysts to have business management or closely related skills, while a background in the physical sciences, applied mathematics, or engineering is preferred for work in scientifically oriented organizations. Art or graphic design skills may be desirable for webmasters or Web developers.

Jobseekers can enhance their employment opportunities by participating in internship or co-op programs offered through their schools. Because many people develop advanced computer skills in one occupation and then transfer those skills into a computer occupation, a related background in the industry in which the job is located, such as financial services, banking, or accounting, can be important. Others have taken computer science courses to supplement their study in fields such as accounting, inventory control, or other business areas. For example, a financial analyst proficient in computers might become a systems analyst or computer support specialist in financial systems development, while a computer programmer might move into a systems analyst job.

Systems analysts, computer scientists, and database administrators must be able to think logically and have good communication skills. They often deal with a number of tasks simultaneously; the ability to concentrate and pay close attention to detail is important. Although these computer specialists sometimes work independently, they often work in teams on large projects. They must be able to communicate effectively with computer personnel, such as programmers and managers, as well as with users or other staff who may have no technical computer background.

Industry: I.T./E-Commerce

Job Needed: Computer Support Specialists

Nature of the Work

Computer support specialists provide technical assistance, support, and advice to customers and other users. This group includes *technical support specialists* and *help-desk technicians*. These troubleshooters interpret problems and provide technical support for hardware, software, and systems. They answer phone calls, analyze problems using automated diagnostic programs, and resolve recurrent difficulties. Support specialists may work either within a company that uses computer systems or directly for a computer hardware or software vendor. Increasingly, these specialists work for help-desk or support services firms, where they provide computer support on a contract basis to clients.

Technical support specialists are troubleshooters, providing valuable assistance to their organization's computer users. Because many non-technical employees are not computer experts, they often run into computer problems they cannot resolve on their own. Technical support specialists install, modify, clean, and repair computer hardware and software. They also may work on monitors, keyboards, printers, and mice.

Technical support specialists answer phone calls from their organizations' computer users and may run automatic diagnostics programs to resolve problems. They also may write training manuals and train computer users how to properly use the new computer hardware and software. In addition, technical support specialists oversee the daily performance of their company's computer systems and evaluate software programs for usefulness.

Help-desk technicians assist computer users with the inevitable hardware and software questions not addressed in a product's instruction manual. Help-desk technicians field telephone calls and e-mail messages from customers seeking guidance on technical problems. In responding to these requests for guidance, help-desk technicians must listen carefully to the customer, ask questions to diagnose the nature of the problem, and then patiently walk the customer through the problem-solving steps.

Help-desk technicians deal directly with customer issues and companies value them as a source of feedback on their products. These technicians are consulted for information about what gives customers the most trouble as well as their concerns. Most computer support specialists start out at the help desk.

Network or computer systems administrators design, install, and support an organization's LAN, WAN, network segment, Internet, or Intranet system. They provide day-to-day onsite administrative support for software users in a variety of work environments, including professional offices, small businesses, government, and large corporations. They maintain network hardware and software, analyze problems, and monitor the

network to ensure availability to system users. These workers gather data to identify customer needs and then use that information to identify, interpret, and evaluate system and network requirements. Administrators also may plan, coordinate, and implement network security measures.

Systems administrators are the information technology employees responsible for the efficient use of networks by organizations. They ensure that the design of an organization's computer site allows all the components, including computers, the network, and software, to fit together and work properly. Furthermore, they monitor and adjust performance of existing networks and continually survey the current computer site to determine future network needs. Administrators also troubleshoot problems as reported by users and automated network monitoring systems and make recommendations for enhancements in the construction of future servers and networks.

In some organizations, *computer security specialists* may plan, coordinate, and implement the organization's information security. These and other growing specialty occupations reflect the increasing emphasis on client-server applications, the expansion of Internet and Intranet applications, and the demand for more end-user support.

Training, Other Qualifications, and Advancement

Due to the wide range of skills required, there is a multitude of ways workers can become a computer support specialist or a systems administrator. While there is no universally accepted way to prepare for a job as a computer support specialist, many employers prefer to hire persons with some formal college education. A bachelor's degree in computer science or information systems is a prerequisite for some jobs; however, other jobs may require only a computer-related associate degree. For systems administrators, many employers seek applicants with bachelor's degrees, though not necessarily in a computer-related field.

Many companies are becoming more flexible about requiring a college degree for support positions because of the explosive demand for specialists. However, certification and practical experience demonstrating these skills will be essential for applicants without a degree. Completion of a certification training program, offered by a variety of vendors and product makers, may help some people to qualify for entry-level positions. Relevant computer experience may substitute for formal education.

Beginning computer support specialists start out at an organization dealing directly with customers or in-house users. Then, they may advance into more responsible positions in which they use what they learn from customers to improve the design and efficiency of future products. Job promotions usually depend more on performance than on formal education. Eventually, some computer support specialists become applications developers, designing products rather than assisting users. Computer support specialists at hardware and software companies often enjoy great upward mobility; advancement sometimes comes within months of initial employment.

Entry-level network and computer systems administrators are involved in routine maintenance and monitoring of computer systems, typically working behind the scenes in an organization. After gaining experience and expertise, they often are able to advance into more senior-level positions in which they take on more responsibilities. For example, senior network and computer systems administrators may present recommendations to management on matters related to a company's network. They also may translate the needs of an organization into a set of technical requirements, based on the available technology. As with support specialists, administrators may become software engineers, actually involved in the designing of the system or network, not just the day-to-day administration.

Persons interested in becoming a computer support specialist or systems administrator must have strong problem-solving, analytical, and communication skills because troubleshooting and helping others are a vital part of the job. The constant interaction with other computer personnel, customers, and employees require computer support specialists and systems administrators to communicate effectively on paper, via e-mail, or in person. Strong writing skills are useful when preparing manuals for employees and customers.

As technology continues to improve, computer support specialists and systems administrators must keep their skills current and acquire new ones. Many continuing education programs are offered by employers, hardware and software vendors, colleges and universities, and private training institutions. Professional development seminars offered by computing services firms also can enhance one's skills.

Industry: I.T./E-Commerce

Job Needed: Repair Technicians

Nature of the Work

Computer repairers, also known as *data processing equipment repairers*, service mainframe, server, and personal computers; printers; and disc drives. These repairers primarily perform hands-on repair, maintenance, and installation of computers and related equipment. Workers who provide technical assistance, in person or by telephone, to computer system users are known as computer support specialists.

Computer repairers usually replace defective components instead of repairing them. Replacement is common because components are inexpensive and businesses are reluctant to shut down their computers for time-consuming repairs. Components commonly replaced by computer repairers include video cards, which transmit signals from the computer to the monitor; hard drives, which store data; and network cards, which allow communication over the network. Defective components may be given to

bench technicians, who use software programs to diagnose the problem and who may repair the components, if possible.

Training, Other Qualifications, and Advancement

Knowledge of electronics is necessary for employment as a computer, automated teller, or office machine repairer. Employers prefer workers who are certified as repairers or who have training in electronics from associate degree programs, the military, vocational schools, or equipment manufacturers. Employers generally provide some training to new repairers on specific equipment; however, workers are expected to arrive on the job with a basic understanding of equipment repair. Employers may send experienced workers to training sessions to keep up with changes in technology and service procedures.

Most office machine and ATM repairer positions require an associate degree in electronics. A basic understanding of mechanical equipment also is important, as many of the parts that fail in office machines and ATMs are mechanical, such as paper loaders. Entry-level employees at large companies normally receive on-the-job training lasting several months. This may include a week of classroom instruction followed by a period of 2 weeks to several months assisting an experienced repairer.

Field technicians work closely with customers and must have good communications skills and a neat appearance. Employers normally require that field technicians have a driver's license.

Several organizations administer certification programs for electronic or computer equipment repairers. Numerous certifications, including A+, Net+, and Server+, are available through the Computing Technology Industry Association (CompTIA). To receive the certifications, candidates must pass several tests that assess computer repair skills. The International Society of Certified Electronics Technicians (ISCET) and the Electronics Technicians Association (ETA) also administer certification programs. Repairers may specialize in computer repair or a variety of other skills. To receive certification, repairers must pass qualifying exams corresponding to their level of training and experience. Both programs offer associate certifications to entry-level repairers.

Newly hired computer repairers may work on personal computers or peripheral equipment. With experience, they can advance to positions maintaining more sophisticated systems, such as networking equipment and servers. Field repairers of ATMs may advance to bench-technician positions responsible for more complex repairs. Experienced workers may become specialists who help other repairers diagnose difficult problems or work with engineers in designing equipment and developing maintenance procedures. Experienced workers also may move into management positions responsible for supervising other repairers.

Because of their familiarity with equipment, experienced repairers also may move into customer service or sales positions. Some experienced workers open their own repair

shops or become wholesalers or retailers of electronic equipment.

Appendix D

Food/Consumer Products

Critical Positions for the Cluster and Region to Prosper

Industry: Food/Consumer Products

Job Needed: Systems Operators

Nature of the Work

Systems operators in the food processing industry include *food batchmakers*, who set up and operate equipment that mixes, blends, or cooks ingredients used in the manufacturing of food products, according to formulas or recipes; *food cooking machine operators and tenders*, who operate or tend cooking equipment, such as steam cooking vats, deep-fry cookers, pressure cookers, kettles, and boilers, to prepare food products, such as meats, sugar, cheese, and grain; and *food and tobacco roasting, baking, and drying machine operators*, who utilize equipment to reduce moisture content of food or tobacco products or to process food in preparation for canning. Some of the machines used include hearth ovens, kiln driers, roasters, char kilns, steam ovens, and vacuum drying equipment.

Training, Other Qualifications, and Advancement

Food machine operators and tenders usually are trained on the job. They learn to run the different types of equipment by watching and helping other workers. Training can last anywhere from 1 month to a year, depending on the complexity of the tasks and the number of products involved. A degree in the appropriate area—dairy processing for those working in dairy product operations, for example—is helpful for advancement to a lead worker or supervisory role. Most food batchmakers participate in on-the-job training. The training period usually is moderate in length, ranging from about a month to a year. Some food batchmakers learn their trade through an approved apprenticeship program.

Industry: Food/Consumer Products

Job Needed: Process Engineers

Nature of the Work

Industrial engineers determine the most effective ways for an organization to use the basic factors of production—people, machines, materials, information, and energy—to make a product or to provide a service. They are the bridge between management goals and operational performance. They are more concerned with increasing productivity through the management of people, methods of business organization, and technology than are engineers in other specialties, who generally work more with products or processes. Although most industrial engineers work in manufacturing industries, they also work in consulting services, healthcare, and communications.

To solve organizational, production, and related problems most efficiently, industrial engineers carefully study the product and its requirements, use mathematical methods

such as operations research to meet those requirements, and design manufacturing and information systems. They develop management control systems to aid in financial planning and cost analysis, design production planning and control systems to coordinate activities and ensure product quality, and design or improve systems for the physical distribution of goods and services. Industrial engineers determine which plant location has the best combination of raw materials availability, transportation facilities, and costs. Industrial engineers use computers for simulations and to control various activities and devices, such as assembly lines and robots. They also develop wage and salary administration systems and job evaluation programs. Many industrial engineers move into management positions because the work is closely related.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering is required for almost all entry-level engineering jobs. College graduates with a degree in a physical science or mathematics occasionally may qualify for some engineering jobs, especially in specialties in high demand. Most engineering degrees are granted in electrical, electronics, mechanical, or civil engineering. However, engineers trained in one branch may work in related branches. For example, many aerospace engineers have training in mechanical engineering. This flexibility allows employers to meet staffing needs in new technologies and specialties in which engineers are in short supply. It also allows engineers to shift to fields with better employment prospects or to those that more closely match their interests.

Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and science. Most programs include a design course, sometimes accompanied by a computer or laboratory class or both.

In addition to the standard engineering degree, many colleges offer 2- or 4-year degree programs in engineering technology. These programs, which usually include various hands-on laboratory classes that focus on current issues, prepare students for practical design and production work, rather than for jobs which require more theoretical and scientific knowledge. Graduates of 4-year technology programs may get jobs similar to those obtained by graduates with a bachelor's degree in engineering. Engineering technology graduates, however, are not qualified to register as professional engineers under the same terms as graduates with degrees in engineering. Some employers regard technology program graduates as having skills between those of a technician and an engineer.

Industry: Food/Consumer Products

Job Needed: Line Operator

Nature of the Work

Food processing occupations include many different types of workers involved in processing raw food products into finished goods ready for sale by grocers or

wholesalers, restaurants, or institutional food services. These workers perform a variety of tasks and are responsible for producing many of the food products found in every household.

Butchers and meat, poultry, and fish cutters and trimmers are employed at different stages in the process by which animal carcasses are converted into manageable pieces of meat suitable for sale to wholesales or consumers. Meat, poultry, and fish cutters and trimmers commonly work in meatpacking or fish and poultry processing plants, while butchers and meatcutters usually are employed at the retail level. As a result of this distinction, the nature of these jobs varies significantly.

In meatpacking plants, *slaughterers and meatpackers* slaughter cattle, hogs, goats, and sheep and cut the carcasses into large wholesale cuts, such as rounds, loins, ribs, and chucks, to facilitate the handling, distribution, and marketing of meat. In some of these plants, slaughterers and meatpackers also further process these primal parts into cuts that are ready for retail use. These workers also produce hamburger meat and meat trimmings, which are used to prepare sausages, luncheon meats, and other fabricated meat products. Slaughterers and meatpackers usually work on assembly lines, with each individual responsible for only a few of the many cuts needed to process a carcass. Depending on the type of cut, they use knives, cleavers, meat saws, bandsaws, or other, often dangerous, equipment.

Unlike some of the occupations listed above, *fish cutters and trimmers*, also called *fish cleaners*, are likely to be employed in both manufacturing and retail establishments. These workers primarily cut, scale, and dress fish by removing the head, scales, and other inedible portions and cutting the fish into steaks or boneless fillets. In retail markets, they may also wait on customers and clean fish to order.

Meat, poultry, and fish cutters and trimmers also prepare ready-to-heat foods. This often entails filleting meat or fish or cutting it into bite-sized pieces, preparing and adding vegetables, or applying sauces or breading.

Bakers mix and bake ingredients in accordance with recipes to produce varying quantities of breads, pastries, and other baked goods for consumption. Bakers commonly are employed in grocery stores and specialty shops and produce small quantities of breads, pastries, and other baked goods for consumption on premises or for sale as specialty baked goods. In manufacturing, bakers produce goods in large quantities, using high-volume mixing machines, ovens, and other equipment. Goods produced in large quantities usually are for sale through establishments such as grocery stores.

Training, Other Qualifications, and Advancement

Training varies widely among food processing occupations. However, most manual food processing workers require little or no training prior to being hired. Most butchers, poultry, and fish cutters and trimmers acquire their skills on the job through formal and informal training programs. The length of training varies significantly. Simple cutting

operations requiring a few days to learn, while more complex tasks, like eviscerating, generally require about a month to learn. On the other hand, the training period for a highly skilled butcher at the retail level may be 1 or 2 years.

Generally, on-the-job trainees begin by doing less difficult jobs, such as simple cuts or removing bones. Under the guidance of experienced workers, trainees learn the proper use of tools and equipment and how to prepare various cuts of meat. After demonstrating skill with various meatcutting tools, they learn to divide carcasses into wholesale cuts and wholesale cuts into retail and individual portions. Trainees also may learn to roll and tie roasts, prepare sausage, and cure meat. Those employed in retail food establishments often are taught operations such as inventory control, meat buying, and record keeping. In addition, growing concern about the safety of meats has led employers to offer extensive training in food safety to employees.

Skills important to meat, poultry, and fish cutters and trimmers include manual dexterity, good depth perception, color discrimination, and good hand-eye coordination. Physical strength often is needed to lift and move heavy pieces of meat. Butchers and fish cleaners who wait on customers should have a pleasant personality, a neat appearance, and the ability to communicate clearly. In some States, a health certificate is required for employment.

Bakers often start off as apprentices or trainees. Apprentice bakers usually start in craft bakeries while in-store bakeries such as supermarkets often employ trainees. Bakers need to be skilled in baking, icing, cake decorating and making calculations. They also need to be able to follow instructions, organize others, have an eye for detail, and communicate well with others. Knowledge of bakery products and ingredients, as well as mechanical mixing and baking equipment, is important. Many apprentice bakers participate in correspondence study and may work towards a certificate in baking. Working as a baker's assistant or at other activities involving handling food also is a useful tool for training. The complexity of the skills required for baker certification often is underestimated. Creating and marketing bakery products requires knowledge of applied chemistry, ingredients and nutrition, government regulations, business concepts, and production processes, including the operation and maintenance of machinery. Modern food plants utilize high-speed, automated machinery that often is operated by computers.

Food processing workers in retail or wholesale establishments may progress to supervisory jobs, such as department managers in supermarkets. A few of these workers may become buyers for wholesalers or supermarket chains. Some open their own markets or bakeries. In processing plants, workers may advance to supervisory positions or become team leaders.

Appendix E

Petrochemical

Critical Positions for the Cluster and Region to Prosper

Industry: Petrochemical

Job Needed: Equipment Operators

Nature of the Work

Machine operators in processing industries typically set up, prepare and adjust processing machinery. They also operate single-function machinery to grind, separate, filter, mix, melt, treat, cast, roll, refine or otherwise process chemicals. Other duties for machine operators in this field are observing gauges, meters, computer print-outs, video monitors and products to ensure the correct operation of machines; verifying specified processing conditions; and making adjustments to machinery as required. Some workers in this field also record production information and complete reports.

Training, Other Qualifications, and Advancement

There are no post-secondary education requirements for most of the occupations in this group. Operators usually receive extensive on-the-job training, provided by their employer. Workers with years of experience likely have an advantage over others seeking work in these fields. Due to the critical nature of most process operations, experienced workers are usually preferred.

Industry: Petrochemical

Job Needed: Equipment Maintenance & Maintenance Supervisors

Nature of the Work

When production workers encounter problems with the machines they operate, they call industrial machinery installation, repair, and maintenance workers. These workers include industrial machinery mechanics, millwrights, and general maintenance and repair and machinery maintenance workers. Their work is important not only because an idle machine will delay production, but also because a machine that is not properly repaired and maintained may damage the final product or injure the operator.

Industrial machinery mechanics repair, install, adjust, or maintain industrial production and processing machinery or refinery and pipeline distribution systems. *Millwrights* install, dismantle, or move machinery and heavy equipment according to layout plans, blueprints, or other drawings. *General maintenance and repair workers* perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of an establishment in repair. *Machinery maintenance workers* lubricate machinery, change parts, or perform other routine machinery maintenance.

Maintenance mechanics must be able to detect and diagnose minor problems and correct them before they become major ones. For example, after hearing a vibration from a machine, the mechanic must decide whether it is due to worn belts, weak motor bearings, or some other problem. Computerized maintenance, vibration analysis techniques, and self-diagnostic systems are making this task easier. Self-diagnostic features on new industrial machinery can determine the cause of a malfunction and, in some cases, alert the mechanic to potential trouble spots before symptoms develop.

After diagnosing the problem, the mechanic disassembles the equipment and repairs or replaces the necessary parts. Once the machine is reassembled, the final step is to test it to ensure that it is running smoothly. When repairing electronically controlled machinery, maintenance mechanics may work closely with electronic repairers or electricians who maintain the machine's electronic parts. However, industrial machinery installation, repair, and maintenance workers increasingly need electronic and computer skills to repair sophisticated equipment on their own.

Although repairing machines is the most important job of industrial machinery installation, repair, and maintenance workers, they also perform preventive maintenance. This includes keeping machines and their parts well oiled, greased, and cleaned. Repairers regularly inspect machinery and check performance. For example, they adjust and calibrate automated manufacturing equipment such as industrial robots, and rebuild components of other industrial machinery. By keeping complete and up-to-date records, mechanics try to anticipate trouble and service equipment before factory production is interrupted.

Training, Other Qualifications, and Advancement

Most industrial machinery installation, repair, and maintenance workers, learn their trade through a 4-year apprenticeship program combining classroom instruction with on-the-job-training. These programs usually are sponsored by a local trade union. Other machinery maintenance workers start as helpers and pick up the skills of the trade informally and by taking courses offered by machinery manufacturers and community colleges.

Trainee repairers learn from experienced repairers how to operate, disassemble, repair, and assemble machinery. Trainees also may work with concrete and receive instruction in related skills, such as carpentry, welding, and sheet metal work. Classroom instruction focuses on subjects such as shop mathematics, blueprint reading, welding, electronics, and computer training.

Most employers prefer to hire those who have completed high school or its equivalency, and who have some vocational training or experience. High school courses in mechanical drawing, mathematics, blueprint reading, physics, computers, and electronics are especially useful.

Mechanical aptitude and manual dexterity are important characteristics for workers in this trade. Good physical conditioning and agility also are necessary because repairers sometimes have to lift heavy objects or climb to reach equipment located high above the floor.

Opportunities for advancement are limited. Industrial machinery installation, repair, and maintenance workers advance either by working with more complicated equipment or by becoming supervisors. The most highly skilled repairers can be promoted to master mechanic or can become machinists or tool and die makers.

Industry: Petrochemical

Job Needed: Chemical Engineers

Nature of the Work

Chemical engineers apply the principles of chemistry and engineering to solve problems involving the production or use of chemicals, building a bridge between science and manufacturing. They design equipment and develop processes for large-scale chemical manufacturing, plan and test methods of manufacturing the products and treating the by-products, and supervise production. Chemical engineers also work in a variety of manufacturing industries other than chemical manufacturing, such as those producing electronics, photographic equipment, clothing, and pulp and paper. They also work in the healthcare, biotechnology, and business services industries.

The knowledge and duties of chemical engineers overlap many fields. Chemical engineers apply principles of chemistry, physics, mathematics, and mechanical and electrical engineering. They frequently specialize in a particular operation such as oxidation or polymerization. Others specialize in a particular area, such as pollution control or the production of specific products such as fertilizers and pesticides, automotive plastics, or chlorine bleach. They must be aware of all aspects of chemicals manufacturing and how it affects the environment, the safety of workers, and customers. Because chemical engineers use computer technology to optimize all phases of research and production, they need to understand how to apply computer skills to process analysis, automated control systems, and statistical quality control.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering is required for almost all entry-level engineering jobs. College graduates with a degree in a physical science or mathematics occasionally may qualify for some engineering jobs, especially in specialties in high demand. Most engineering degrees are granted in electrical, electronics, mechanical, or civil engineering. However, engineers trained in one branch may work in related branches. For example, many aerospace engineers have training in mechanical engineering. This

flexibility allows employers to meet staffing needs in new technologies and specialties in which engineers are in short supply. It also allows engineers to shift to fields with better employment prospects or to those that more closely match their interests.

Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and science. Most programs include a design course, sometimes accompanied by a computer or laboratory class or both.

In addition to the standard engineering degree, many colleges offer 2- or 4-year degree programs in engineering technology. These programs, which usually include various hands-on laboratory classes that focus on current issues, prepare students for practical design and production work, rather than for jobs which require more theoretical and scientific knowledge. Graduates of 4-year technology programs may get jobs similar to those obtained by graduates with a bachelor's degree in engineering. Engineering technology graduates, however, are not qualified to register as professional engineers under the same terms as graduates with degrees in engineering. Some employers regard technology program graduates as having skills between those of a technician and an engineer.

Graduate training is essential for engineering faculty positions and many research and development programs, but is not required for the majority of entry-level engineering jobs. Many engineers obtain graduate degrees in engineering or business administration to learn new technology and broaden their education. Many high-level executives in government and industry began their careers as engineers.

About 330 colleges and universities offer bachelor's degree programs in engineering that are accredited by the Accreditation Board for Engineering and Technology (ABET), and about 250 colleges offer accredited bachelor's degree programs in engineering technology. ABET accreditation is based on an examination of an engineering program's student achievement, program improvement, faculty, curricular content, facilities, and institutional commitment. Although most institutions offer programs in the major branches of engineering, only a few offer programs in the smaller specialties. Also, programs of the same title may vary in content. For example, some programs emphasize industrial practices, preparing students for a job in industry, whereas others are more theoretical and are designed to prepare students for graduate work. Therefore, students should investigate curricula and check accreditations carefully before selecting a college.

Admissions requirements for undergraduate engineering schools include a solid background in mathematics (algebra, geometry, trigonometry, and calculus) and sciences (biology, chemistry, and physics), and courses in English, social studies, humanities, and computers.

Bachelor's degree programs in engineering typically are designed to last 4 years, but many students find that it takes between 4 and 5 years to complete their studies. In a typical 4-year college curriculum, the first 2 years are spent studying mathematics, basic sciences, introductory engineering, humanities, and social sciences. In the last 2 years,

most courses are in engineering, usually with a concentration in one branch. For example, the last 2 years of an aerospace program might include courses in fluid mechanics, heat transfer, applied aerodynamics, analytical mechanics, flight vehicle design, trajectory dynamics, and aerospace propulsion systems. Some programs offer a general engineering curriculum; students then specialize in graduate school or on the job.

Some engineering schools and 2-year colleges have agreements whereby the 2-year college provides the initial engineering education, and the engineering school automatically admits students for their last 2 years. In addition, a few engineering schools have arrangements whereby a student spends 3 years in a liberal arts college studying pre-engineering subjects and 2 years in an engineering school studying core subjects, and then receives a bachelor's degree from each school. Some colleges and universities offer 5-year master's degree programs. Some 5- or even 6-year cooperative plans combine classroom study and practical work, permitting students to gain valuable experience and finance part of their education. All 50 States and the District of Columbia usually require licensure for engineers who offer their services directly to the public. Engineers who are licensed are called Professional Engineers (PE). This licensure generally requires a degree from an ABET-accredited engineering program, 4 years of relevant work experience, and successful completion of a State examination. Recent graduates can start the licensing process by taking the examination in two stages. The initial Fundamentals of Engineering (FE) examination can be taken upon graduation. Engineers who pass this examination commonly are called Engineers in Training (EIT) or Engineer Interns (EI). The EIT certification usually is valid for 10 years. After acquiring suitable work experience, EITs can take the second examination, the Principles and Practice of Engineering Exam. Several states have imposed mandatory continuing education requirements for relicensure. Most States recognize licensure from other States. Many civil, electrical, mechanical, and chemical engineers are licensed as PEs.

Engineers should be creative, inquisitive, analytical, and detail-oriented. They should be able to work as part of a team and to communicate well, both orally and in writing. Communication abilities are becoming more important because much of their work is becoming more diversified, meaning that engineers interact with specialists in a wide range of fields outside engineering.

Beginning engineering graduates usually work under the supervision of experienced engineers and, in large companies, also may receive formal classroom or seminar-type training. As new engineers gain knowledge and experience, they are assigned more difficult projects with greater independence to develop designs, solve problems, and make decisions. Engineers may advance to become technical specialists or to supervise a staff or team of engineers and technicians. Some may eventually become engineering managers or enter other managerial or sales jobs.

Appendix F

Oil and Gas

Critical Positions for the Cluster and Region to Prosper

Industry: Oil and Gas

Job Needed: Petroleum Engineers

Nature of the Work

Petroleum engineers search the world for reservoirs containing oil or natural gas. Once these are discovered, petroleum engineers work with geologists and other specialists to understand the geologic formation and properties of the rock containing the reservoir, determine the drilling methods to be used, and monitor drilling and production operations. They design equipment and processes to achieve the maximum profitable recovery of oil and gas. Petroleum engineers rely heavily on computer models to simulate reservoir performance using different recovery techniques. They also use computer models for simulations of the effects of various drilling options.

Because only a small proportion of oil and gas in a reservoir will flow out under natural forces, petroleum engineers develop and use various enhanced recovery methods. These include injecting water, chemicals, gases, or steam into an oil reservoir to force out more of the oil, and computer-controlled drilling or fracturing to connect a larger area of a reservoir to a single well. Because even the best techniques in use today recover only a portion of the oil and gas in a reservoir, petroleum engineers research and develop technology and methods to increase recovery and lower the cost of drilling and production operations.

Training, Other Qualifications, and Advancement

The training and qualifications for this job are similar those of other engineering disciplines described in this Appendix.

Industry: Oil and Gas

Job Needed: Geologists

Nature of the Work

Environmental scientists and geoscientists use their knowledge of the physical makeup and history of the Earth to locate water, mineral, and energy resources; protect the environment; predict future geologic hazards; and offer advice on construction and land use projects.

Environmental scientists conduct research to identify and abate or eliminate sources of pollutants that affect people, wildlife, and their environments. They analyze and report measurements and observations of air, water, soil, and other sources to make recommendations on how best to clean and preserve the environment. They often use

their skills and knowledge to design and monitor waste disposal sites, preserve water supplies, and reclaim contaminated land and water to comply with Federal environmental regulations.

Geoscientists study the composition, structure, and other physical aspects of the Earth. By using sophisticated instruments and analyses of the earth and water, geoscientists study the Earth's geologic past and present in order to make predictions about its future. For example, they may study the Earth's movements to try to predict when and where the next earthquake or volcano will occur and the probable impact on surrounding areas to minimize the damage. Many geoscientists are involved in the search for oil and gas, while others work closely with environmental scientists in preserving and cleaning up the environment.

Geoscientists usually study, and are subsequently classified in, one of several closely related fields of geoscience, including geology, geophysics, and oceanography. *Geologists* study the composition, processes, and history of the Earth. They try to find out how rocks were formed and what has happened to them since formation. They also study the evolution of life by analyzing plant and animal fossils. *Geophysicists* use the principles of physics, mathematics, and chemistry to study not only the Earth's surface, but also its internal composition; ground and surface waters; atmosphere; oceans; and its magnetic, electrical, and gravitational forces. *Oceanographers* use their knowledge of geology and geophysics, in addition to biology and chemistry, to study the world's oceans and coastal waters. They study the motion and circulation of the ocean waters and their physical and chemical properties, and how these properties affect coastal areas, climate, and weather.

Geoscientists can spend a large part of their time in the field identifying and examining rocks, studying information collected by remote sensing instruments in satellites, conducting geological surveys, constructing field maps, and using instruments to measure the Earth's gravity and magnetic field. For example, they often perform seismic studies, which involve bouncing energy waves off buried rock layers, to search for oil and gas or understand the structure of subsurface rock layers. Seismic signals generated by earthquakes are used to determine the earthquake's location and intensity.

In laboratories, geologists and geophysicists examine the chemical and physical properties of specimens. They study fossil remains of animal and plant life or experiment with the flow of water and oil through rocks. Some geoscientists use two- or three-dimensional computer modeling to portray water layers and the flow of water or other fluids through rock cracks and porous materials. They use a variety of sophisticated laboratory instruments, including x-ray diffractometers, which determine the crystal structure of minerals, and petrographic microscopes, for the study of rock and sediment samples.

Geoscientists working in mining or the oil and gas industry sometimes process and interpret data produced by remote sensing satellites to help identify potential new mineral, oil, or gas deposits. Seismic technology also is an important exploration tool. Seismic waves are used to develop a three-dimensional picture of underground or

underwater rock formations. Seismic reflection technology may also reveal unusual underground features that sometimes indicate accumulations of natural gas or petroleum, facilitating exploration and reducing the risks associated with drilling in previously unexplored areas.

Numerous sub disciplines or specialties fall under the two major disciplines of geology and geophysics that further differentiate the type of work geoscientists do. For example, *petroleum geologists* explore for oil and gas deposits by studying and mapping the subsurface of the ocean or land. They use sophisticated geophysical instrumentation, well log data, and computers to interpret geological information. *Engineering geologists* apply geologic principles to the fields of civil and environmental engineering, offering advice on major construction projects and assisting in environmental remediation and natural hazard reduction projects. *Mineralogists* analyze and classify minerals and precious stones according to composition and structure and study their environment in order to find new mineral resources. *Paleontologists* study fossils found in geological formations to trace the evolution of plant and animal life and the geologic history of the Earth. *Stratigraphers* study the formation and layering of rocks to understand the environment in which they were formed. *Volcanologists* investigate volcanoes and volcanic phenomena to try to predict the potential for future eruptions and possible hazards to human health and welfare.

Geophysicists may specialize in areas such as geodesy, seismology, or magnetic geophysics. *Geodesists* study the size and shape of the Earth, its gravitational field, tides, polar motion, and rotation. *Seismologists* interpret data from seismographs and other geophysical instruments to detect earthquakes and locate earthquake-related faults. *Geochemists* study the nature and distribution of chemical elements in ground water and Earth materials. *Geomagnetists* measure the Earth's magnetic field and use measurements taken over the past few centuries to devise theoretical models to explain the Earth's origin. *Paleomagnetists* interpret fossil magnetization in rocks and sediments from the continents and oceans, to record the spreading of the sea floor, the wandering of the continents, and the many reversals of polarity that the Earth's magnetic field has undergone through time. Other geophysicists study atmospheric sciences and space physics.

Hydrology is closely related to the disciplines of geology and geophysics. *Hydrologists* study the quantity, distribution, circulation, and physical properties of underground and surface waters. They study the form and intensity of precipitation, its rate of infiltration into the soil, its movement through the Earth, and its return to the ocean and atmosphere. The work they do is particularly important in environmental preservation, remediation, and flood control.

Oceanography also has several sub disciplines. *Physical oceanographers* study the ocean tides, waves, currents, temperatures, density, and salinity. They study the interaction of various forms of energy, such as light, radar, sound, heat, and wind with the sea, in addition to investigating the relationship between the sea, weather, and climate. Their studies provide the Maritime Fleet with up-to-date oceanic conditions. *Chemical*

oceanographers study the distribution of chemical compounds and chemical interactions that occur in the ocean and sea floor. They may investigate how pollution affects the chemistry of the ocean. *Geological and geophysical oceanographers* study the topographic features and the physical makeup of the ocean floor. Their knowledge can help oil and gas producers find these minerals on the bottom of the ocean. *Biological oceanographers*, often called marine biologists, study the distribution and migration patterns of the many diverse forms of sea life in the ocean.

Training, Other Qualifications, and Advancement

A bachelor's degree in geology or geophysics is adequate for some entry-level geoscientist jobs, but more job opportunities and better jobs with good advancement potential usually require at least a master's degree in geology or geophysics. Environmental scientists require at least a bachelor's degree in hydrogeology; environmental, civil, or geological engineering; or geochemistry or geology, but employers usually prefer candidates with master's degrees. A master's degree is required for most entry-level research positions in colleges and universities, Federal agencies, and State geological surveys. A Ph.D. is necessary for most high-level research positions.

Hundreds of colleges and universities offer a bachelor's degree in geology; fewer schools offer programs in geophysics, hydrogeology, or other geosciences. Other programs offering related training for beginning geological scientists include geophysical technology, geophysical engineering, geophysical prospecting, engineering geology, petroleum geology, geohydrology, and geochemistry. In addition, several hundred universities award advanced degrees in geology or geophysics.

Traditional geoscience courses emphasizing classical geologic methods and topics (such as mineralogy, petrology, paleontology, stratigraphy, and structural geology) are important for all geoscientists and make up the majority of college training. Persons studying physics, chemistry, biology, mathematics, engineering, or computer science may also qualify for some environmental science and geoscience positions if their coursework includes study in geology. Those students interested in working in the environmental or regulatory fields, either in environmental consulting firms or for Federal or State governments, should take courses in hydrology, hazardous waste management, environmental legislation, chemistry, fluid mechanics, and geologic logging. An understanding of environmental regulations and government permit issues is also valuable for those planning to work in mining and oil and gas extraction. Hydrologists and environmental scientists should have some knowledge of the potential liabilities associated with some environmental work. Computer skills are essential for prospective environmental scientists and geoscientists; students who have some experience with computer modeling, data analysis and integration, digital mapping, remote sensing, and geographic information systems (GIS) will be the most prepared entering the job market. A knowledge of the Global Positioning System (GPS)—a locator system that uses satellites—also is very helpful. Some employers seek applicants with field experience, so a summer internship may be beneficial to prospective geoscientists.

Environmental scientists and geoscientists must have excellent interpersonal skills, because they usually work as part of a team with other scientists, engineers, and technicians. Strong oral and written communication skills also are important, because writing technical reports and research proposals, as well as communicating research results to others, are important aspects of the work. Because many jobs require foreign travel, knowledge of a second language is becoming an important attribute to employers. Geoscientists must be inquisitive and able to think logically and have an open mind. Those involved in fieldwork must have physical stamina.

Environmental scientists and geoscientists often begin their careers in field exploration or as research assistants or technicians in laboratories or offices. They are given more difficult assignments as they gain experience. Eventually, they may be promoted to project leader, program manager, or another management and research position.

Industry: Oil and Gas

Job Needed: Drillers/Roughnecks

Nature of the Work

Rotary drilling crews usually consist of four or five workers. *Rotary drillers* supervise the crew and operate machinery that controls drilling speed and pressure. *Rotary-rig engine operators* are in charge of engines that provide the power for drilling and hoisting. Second in charge, *derrick operators* work on small platforms high on rigs to help run pipe in and out of well holes and operate the pumps that circulate mud through the pipe. *Rotary-driller helpers*, also known as *roughnecks*, guide the lower ends of pipe to well openings and connect pipe joints and drill bits.

Though not necessarily part of the drilling crew, *roustabouts*, or general laborers, do general oil field maintenance and construction work, such as cleaning tanks and building roads.

Oil and gas well drilling and servicing can be hazardous. However, in 1999, the rate of work-related injury and illness in the oil and gas extraction industry, as a whole, was 3.5 per 100 full-time workers, somewhat lower than the 6.3 for the entire private sector. The rate for workers in the oil and gas field services segment, 4.8 per 100 full-time workers, was nearly 3 times higher than that for workers in the crude petroleum and natural gas segment, which was only 1.7.

Drilling rigs operate continuously. On land, drilling crews usually work 6 days, 8 hours a day, and then have a few days off. In offshore operations, workers can work 14 days, 12 hours a day, and then have 14 days off. If the offshore rig is located far from the coast, drilling crew members live on ships anchored nearby or in facilities on the platform itself. Workers on offshore rigs are always evacuated in the event of a storm. Most workers in

oil and gas well operations and maintenance or in natural gas processing work 8 hours a day, 5 days a week.

Many oilfield workers are away from home for weeks or months at a time. Exploration field personnel and drilling workers frequently move from place to place as work at a particular field is completed. In contrast, well operation and maintenance workers and natural gas processing workers usually remain in the same location for extended periods.

Training, Other Qualifications, and Advancement

Workers can enter the oil and gas extraction industry with a variety of educational backgrounds. The most common entry-level field jobs are as roustabouts or roughnecks, jobs that usually require little or no previous training or experience. Applicants for these routine laborer jobs must be physically fit and able to pass a physical examination. Companies also may administer aptitude tests and screen prospective employees for drug use. Basic skills usually can be learned over a period of days through on-the-job training. However, previous work experience or formal training in petroleum technology that provides knowledge of oil field operations and familiarity with computers and other automated equipment can be beneficial. In fact, given the increasing complexity of operations and the sophisticated nature of technology used today, employers now demand a higher level of skill and adaptability, including the ability to work with computers and other sophisticated equipment.

Other entry-level positions, such as engineering technician, usually require at least a 2-year associate degree in engineering technology. Professional jobs, such as geologist, geophysicist, or petroleum engineer, require at least a bachelor's degree, but many companies prefer to hire candidates with a master's degree, and may require Ph.D. for those involved in petroleum research. For well operation and maintenance jobs, companies generally prefer applicants who live nearby, have mechanical ability, and possess knowledge of oilfield processes. Because this work offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel may transfer to well operation and maintenance jobs. Training is acquired on the job.

Promotion opportunities for some jobs may be limited due to the general decline of the domestic petroleum industry. Advancement opportunities for oilfield workers remain best for those with skill and experience. For example, roustabouts may move up to become switchers, gaugers, and pumpers. More experienced roughnecks may advance to derrick operator and, after several years, to driller. Drillers may advance to tool pusher. There should continue to be some opportunities for entry-level field crew workers to acquire the skills that qualify them for higher level jobs within the industry. Due to the critical nature of the work, offshore crews, even at the entry level, generally are more experienced than land crews. Many companies will not employ someone who has no knowledge of oilfield operations to work on an offshore rig, so workers who have gained experience as part of a land crew might advance to offshore operations.

As workers gain knowledge and experience, U.S. or foreign companies operating in other countries also may hire them. Although this can be a lucrative and exciting experience, it may not be suitable for everyone, because it usually means leaving family and friends and adapting to different customs and living standards.

Experience gained in many oil and gas extraction jobs also has application in other industries. For example, roustabouts can move to construction jobs, while machinery operators and repairers can transfer to other industries with similar machinery. Geologists and engineers may become involved with environmental activities, especially those related to this industry.

Industry: Oil and Gas

Job Needed: Service Operators (offshore)

Nature of the Work

The nature of the work is similar to that of land based exploration and productions occupations; however, offshore work is structured so that employees will work a certain amount of weeks ON with an equal amount of time OFF. Workers and operators in this field are employed by drilling and well service contractors and by petroleum producing companies.

Oil and gas drilling workers are key to the removal or replacement of strings of pipe, drill stems and drill bits on big rig derricks. Their primary duties are to manipulate and align sections of pipe or drill stem from the rig platform. In addition to performing these duties, drilling workers also operate and maintain drilling mud systems, pumps, drilling rig diesel motors, transmissions and other mechanical equipment during drilling. They also mix mud chemicals and additives and take mud samples. Other oil and gas drilling duties include recording mud flows and volumes and assisting in setting up, taking down and transporting drilling and service rigs. Some workers in this field also supervise floor hands and laborers. They also attach pumps and hoses to wellheads; read gauges to interpret conditions and adjust pumping procedures; and operate hydraulic pumping systems to pump chemicals, gases, sand, cement or other materials into a well. Some oil and gas well service operators mix chemicals and cements

Training, Other Qualifications, and Advancement

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Appendix G

Entertainment

Critical Positions for the Cluster and Region to Prosper

Industry: Entertainment

Job Needed: Production Crew Members

Nature of the Work

Television, video, and motion picture camera operators produce images that tell a story, inform or entertain an audience, or record an event. *Film and video editors* edit soundtracks, film, and video for the motion picture, cable, and broadcast television industries. Some camera operators do their own editing.

Making commercial quality movies and video programs requires technical expertise and creativity. Producing successful images requires choosing and presenting interesting material, selecting appropriate equipment, and applying a good eye and steady hand to assure smooth natural movement of the camera.

Camera operators use television, video, or motion picture cameras to shoot a wide range of subjects, including television series, studio programs, news and sporting events, music videos, motion pictures, documentaries, and training sessions. Some film or videotape private ceremonies and special events. Those who record images on videotape are often called *videographers*. Many are employed by independent television stations, local affiliates, large cable and television networks, or smaller, independent production companies. *Studio camera operators* work in a broadcast studio and usually videotape their subjects from a fixed position. *News camera operators*, also called *electronic news gathering (ENG) operators*, work as part of a reporting team, following newsworthy events as they unfold. To capture live events, they must anticipate the action and act quickly. ENG operators may need to edit raw footage on the spot for relay to a television affiliate for broadcast.

Camera operators employed in the entertainment field use motion picture cameras to film movies, television programs, and commercials. Those who film motion pictures are also known as *cinematographers*. Some specialize in filming cartoons or special effects. They may be an integral part of the action, using cameras in any of several different camera mounts. For example, the camera operator can be stationary and shoot whatever passes in front of the lens, or the camera can be mounted on a track, with the camera operator responsible for shooting the scene from different angles or directions. Other camera operators sit on cranes and follow the action, while crane operators move them into position. *Steadicam operators* mount a harness and carry the camera on their shoulders to provide a more solid picture while they move about the action. Camera operators who work in the entertainment field often meet with directors, actors, editors, and camera assistants to discuss ways of filming, editing, and improving scenes.

Training, Other Qualifications, and Advancement

Employers usually seek applicants with a "good eye," imagination, and creativity, as well as a good technical understanding of camera operation. Camera operators and editors

usually acquire their skills through on-the-job training or formal postsecondary training at vocational schools, colleges, universities, or photographic institutes. Formal education may be required for some positions.

Many universities, community and junior colleges, vocational-technical institutes, and private trade and technical schools offer courses in camera operation and videography. Basic courses cover equipment, processes, and techniques. Bachelor's degree programs, especially those including business courses, provide a well-rounded education. Individuals interested in camera operations should subscribe to videographic newsletters and magazines, join clubs, and seek summer or part-time employment in cable and television networks, motion picture studios, or camera and video stores.

For most occupations in this unit group, completion of a college or university program in broadcasting, theatre arts or a related field and several years of experience in a related support or assisting occupation in motion pictures, broadcasting or the performing arts are required. Floor managers require a portfolio of work. Make-up artists working in motion pictures, broadcasting and the performing arts may require a training program. Creative ability, as demonstrated by a portfolio of work, is required for make-up artists.

Industry: Entertainment

Job Needed: Gaffers/Grips

Nature of the Work

Gaffers and lighting technicians set up, operate and make repairs to lights and other electrical equipment in studios and on sets and stages. Key grips supervise grips, gaffers and stagehands who rig, place, move and dismantle lights, sets, backdrops, scenery and other stage equipment.

Training, Other Qualifications, and Advancement

For gaffers, lighting technicians, key grips and other stage technicians, completion of a college program or other specialized training program in technical production for theatre is required. Membership in a related union may also be an advantage.

For those looking to get into the recording and motion picture business or just to learn their craft well, education has become a near necessity. It used to be you could move to a city where there was a vibrant music and recording scene, get a job as a runner and work your way up the ladder. There is a story in the recording industry about ace engineer Al Schmitt when he was coming up. Al was delivering something to the studio and more or less stumbled into the job by just being in the right place at the right time. Those days are long gone and the gear has become much more complex. This has raised the bar for operators and required up-and-coming engineers to know their craft better than ever.

Industry: Entertainment

Job Needed: Food service/lodging Managers

Nature of the Work

The daily responsibilities of many food service managers can often be as complicated as some of the meals prepared by a fine chef. In addition to the traditional duties of selecting and pricing menu items, using food and other supplies efficiently, and achieving quality in food preparation and service, managers now are responsible for a growing number of administrative and human resource tasks. For example, managers must carefully find and evaluate new ways of recruiting employees in a tight job market. Once hired, managers also must find creative ways to retain experienced workers.

In most restaurants and institutional food service facilities, the manager is assisted in these duties by one or more assistant managers, depending on the size and operating hours of the establishment. In most large establishments, as well as in many smaller ones, the management team consists of a *general manager*, one or more *assistant managers*, and an *executive chef*. The executive chef is responsible for the operation of the kitchen, while the assistant managers oversee service in the dining room and other areas. In smaller restaurants, the executive chef also may be the general manager, and sometimes an owner. In fast-food restaurants and other food service facilities open for long hours.—often 7 days a week—several assistant managers, each of whom supervises a shift of workers, aid the manager.

One of the most important tasks of food service managers is selecting successful menu items. This task varies by establishment because, although many restaurants rarely change their menu, others make frequent alterations. Managers or executive chefs select menu items, taking into account the likely number of customers and the past popularity of dishes. Other issues taken into consideration when planning a menu include unserved food left over from prior meals that should not be wasted, the need for variety, and the seasonal availability of foods. Managers or executive chefs analyze the recipes of the dishes to determine food, labor, and overhead costs, and to assign prices to various dishes. Menus must be developed far enough in advance that supplies can be ordered and received in time.

On a daily basis, managers estimate food consumption, place orders with suppliers, and schedule the delivery of fresh food and beverages. They receive and check the content of deliveries, evaluating the quality of meats, poultry, fish, fruits, vegetables, and baked goods. To ensure good service, managers meet with sales representatives from restaurant suppliers to place orders replenishing stocks of tableware, linens, paper, cleaning supplies, cooking utensils, and furniture and fixtures. They also arrange for equipment maintenance and repairs, and coordinate a variety of services such as waste removal and pest control.

The quality of food dishes and services in restaurants depends largely on a manager's ability to interview, hire, and, when necessary, fire employees. This is especially true in tight labor markets, when many managers report difficulty in hiring experienced food and beverage preparation and service workers. Managers may attend career fairs or arrange for newspaper advertising to expand their pool of applicants. Once a new employee is hired, managers explain the establishment's policies and practices and oversee any necessary training. Managers also schedule the work hours of employees, making sure there are enough workers present to cover peak dining periods. If employees are unable to work, managers may have to fill in for them. Some managers regularly help with cooking, clearing of tables, or other tasks.

Another fundamental responsibility of food service managers is supervising the kitchen and dining room. For example, managers often oversee all food preparation and cooking, examining the quality and portion sizes to ensure that dishes are prepared and garnished correctly and in a timely manner. They also investigate and resolve customers' complaints about food quality or service. To maintain company and government sanitation standards, they direct the cleaning of the kitchen and dining areas and washing of tableware, kitchen utensils, and equipment. Managers also monitor the actions of their employees and patrons on a continual basis to ensure that health and safety standards and local liquor regulations are obeyed.

In addition to their regular duties, food service managers have a variety of administrative responsibilities. Although much of this work is delegated to a bookkeeper in a larger establishment, managers in most smaller establishments, such as fast-food restaurants, must keep records of the hours and wages of employees, prepare the payroll, and fill out paperwork in compliance with licensing laws and reporting requirements of tax, wage and hour, unemployment compensation, and Social Security laws. Managers also maintain records of supply and equipment purchases and ensure that accounts with suppliers are paid on a regular basis. In addition, managers in full-service restaurants record the number, type, and cost of items sold to evaluate and discontinue dishes that may be unpopular or less profitable.

Many managers are able to ease the burden of recordkeeping and paperwork through the use of computers. Point-of-service (POS) systems are used in many restaurants to increase employee productivity and allow managers to track the sales of specific menu items. Using a POS system, a server keys in the customer's order, and the computer immediately sends the order to the kitchen so that preparation can begin. The same system totals checks, acts as a cash register and credit card authorizer, and tracks daily sales. To minimize food costs and spoilage, many managers use inventory-tracking software to compare the record of daily sales from the POS with a record of present inventory. In some establishments, when supplies needed for the preparation of popular menu items run low, additional inventory can be ordered directly from the supplier using the computer. Computers also allow restaurant and food service managers to more efficiently keep track of employee schedules and pay.

Technology also impacts the job of food service managers in many other ways, helping to enhance efficiency and productivity. According to the 2000 National Restaurant Association's Tableservice Operator Survey, for example, Internet uses by food service managers included tracking industry news, finding recipes, conducting market research, purchasing supplies or equipment, recruiting employees, and training staff. Internet access also makes service to customers more efficient. Many restaurants maintain websites that include menus and online promotions and provide information about the restaurant's location and the option to make a reservation.

Managers are among the first to arrive in the morning and the last to leave. At the conclusion of each day, or sometimes each shift, managers tally the cash and charge receipts received and balance them against the record of sales. In most cases, they are responsible for depositing the day's receipts at the bank or securing them in a safe place. Finally, managers are responsible for locking up, checking that ovens, grills, and lights are off, and switching on alarm systems.

Training, Other Qualifications, and Advancement

Most food service management companies and national or regional restaurant chains recruit management trainees from 2- and 4-year college hospitality management programs. Food service and restaurant chains prefer to hire people with degrees in restaurant and institutional food service management, but they often hire graduates with degrees in other fields who have demonstrated interest and aptitude. Some restaurant and food service manager positions, particularly self-service and fast food, are filled by promoting experienced food and beverage preparation and service workers. Waiters, waitresses, chefs, and fast-food workers demonstrating potential for handling increased responsibility sometimes advance to assistant manager or management trainee jobs. Executive chefs need extensive experience working as chefs, and general managers need experience as assistant managers.

A bachelor's degree in restaurant and food service management provides a particularly strong preparation for a career in this occupation. A number of colleges and universities offer 4-year programs in restaurant and hotel management or institutional food service management. For those not interested in pursuing a 4-year degree, community and junior colleges, technical institutes, and other institutions offer programs in these fields leading to an associate degree or other formal certification. Both 2- and 4-year programs provide instruction in subjects such as nutrition and food planning and preparation, as well as accounting, business law and management, and computer science. Some programs combine classroom and laboratory study with internships that provide on-the-job experience. In addition, many educational institutions offer culinary programs that provide food preparation training. This training can lead to a career as a cook or chef and provide a foundation for advancement to an executive chef position.

Most restaurant chains and food service management companies have rigorous training programs for management positions. Through a combination of classroom and on-the-job training, trainees receive instruction and gain work experience in all aspects of the

operations of a restaurant or institutional food service facility. Topics include food preparation, nutrition, sanitation, security, company policies and procedures, personnel management, recordkeeping, and preparation of reports. Training on use of the restaurant's computer system is increasingly important as well. Usually after 6 months or a year, trainees receive their first permanent assignment as an assistant manager.

Most employers emphasize personal qualities when hiring managers. For example, self-discipline, initiative, and leadership ability are essential. Managers must be able to solve problems and concentrate on details. They need good communication skills to deal with customers and suppliers, as well as to motivate and direct their staff. A neat and clean appearance is a must because they often are in close personal contact with the public. Food service management can be demanding, so good health and stamina also are important.

The certified Foodservice Management Professional (FMP) designation is a measure of professional achievement for food service managers. Although not a requirement for employment or advancement in the occupation, voluntary certification provides recognition of professional competence, particularly for managers who acquired their skills largely on the job. The Educational Foundation of the National Restaurant Association awards the FMP designation to managers who achieve a qualifying score on a written examination, complete a series of courses that cover a range of food service management topics, and meet standards of work experience in the field.

Willingness to relocate often is essential for advancement to positions with greater responsibility. Managers typically advance to larger establishments or regional management positions within restaurant chains. Some eventually open their own eating and drinking establishments. Others transfer to hotel management positions because their restaurant management experience provides a good background for food and beverage manager jobs in hotels and resorts.

Industry: Entertainment

Job Needed: Sound Technicians

Nature of the Work

Audio and video recording technicians operate equipment to record, mix and edit sound, music and videotape, for motion pictures, television and radio programs, videos, recordings and live events. They are employed by film, video and concert production companies, sound recording firms, theatre and dance companies, clubs, bands, multimedia companies, radio stations, television networks and video production and editing companies.

Specific duties may include:

- Setting up, preparing, operating and adjusting audio, recording, editing and reproducing equipment to record, edit and reproduce sound input or feed of pre-recorded material from tapes, records, compact discs, digital audio devices, and input from live microphones, satellites or microwave trucks for films, videos, radio and television programs and recordings.
- Prepare and operate videotape recording and playback equipment to record videos, television programs, concerts and live events, and to edit video tape after production Operate electronic equipment to generate program titles, credits, sub-titles, graphic backgrounds or animation for television programs.
- Operate audio consoles or computers, tape machines, microphones and sound processing equipment to mix, combine and edit music and sound at concerts and live events Operate dubbing machines to play back edited dialogue, music and sound effect tracks from different sources, in synchronization with motion picture film.
- May supervise and co-ordinate the work of other audio and video recording technicians.

Training, Other Qualifications, and Advancement

Obtaining these positions will usually involve completion of a college or other program in recording engineering, audiovisual technology or a related field. Experience as a recording studio assistant is usually required. Senior occupations in this unit group, such as recording and sound engineers, require experience.



Appendix H

Other in Demand Jobs that are not Critical to Their Respective Clusters

Job Needed: Civil Engineers

Nature of the Work

Civil engineers design and supervise the construction of roads, buildings, airports, tunnels, dams, bridges, and water supply and sewage systems. Civil engineering, considered one of the oldest engineering disciplines, encompasses many specialties. The major specialties within civil engineering are structural, water resources, environmental, construction, transportation, and geotechnical engineering. Many civil engineers hold supervisory or administrative positions, from supervisor of a construction site to city engineer. Others may work in design, construction, research, and teaching.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering is required for almost all entry-level engineering jobs. College graduates with a degree in a physical science or mathematics occasionally may qualify for some engineering jobs, especially in specialties in high demand. Most engineering degrees are granted in electrical, electronics, mechanical, or civil engineering. However, engineers trained in one branch may work in related branches. For example, many aerospace engineers have training in mechanical engineering. This flexibility allows employers to meet staffing needs in new technologies and specialties in which engineers are in short supply. It also allows engineers to shift to fields with better employment prospects or to those that more closely match their interests. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and science. Most programs include a design course, sometimes accompanied by a computer or laboratory class or both.

In addition to the standard engineering degree, many colleges offer 2- or 4-year degree programs in engineering technology. These programs, which usually include various hands-on laboratory classes that focus on current issues, prepare students for practical design and production work, rather than for jobs which require more theoretical and scientific knowledge. Graduates of 4-year technology programs may get jobs similar to those obtained by graduates with a bachelor's degree in engineering. Engineering technology graduates, however, are not qualified to register as professional engineers under the same terms as graduates with degrees in engineering. Some employers regard technology program graduates as having skills between those of a technician and an engineer.

Graduate training is essential for engineering faculty positions and many research and development programs, but is not required for the majority of entry-level engineering jobs. Many engineers obtain graduate degrees in engineering or business administration to learn new technology and broaden their education. Many high-level executives in government and industry began their careers as engineers.

About 330 colleges and universities offer bachelor's degree programs in engineering that are accredited by the Accreditation Board for Engineering and Technology (ABET), and

about 250 colleges offer accredited bachelor's degree programs in engineering technology. ABET accreditation is based on an examination of an engineering program's student achievement, program improvement, faculty, curricular content, facilities, and institutional commitment. Although most institutions offer programs in the major branches of engineering, only a few offer programs in the smaller specialties. Also, programs of the same title may vary in content. For example, some programs emphasize industrial practices, preparing students for a job in industry, whereas others are more theoretical and are designed to prepare students for graduate work. Therefore, students should investigate curricula and check accreditations carefully before selecting a college.

Admissions requirements for undergraduate engineering schools include a solid background in mathematics (algebra, geometry, trigonometry, and calculus) and sciences (biology, chemistry, and physics), and courses in English, social studies, humanities, and computers. Bachelor's degree programs in engineering typically are designed to last 4 years, but many students find that it takes between 4 and 5 years to complete their studies. In a typical 4-year college curriculum, the first 2 years are spent studying mathematics, basic sciences, introductory engineering, humanities, and social sciences. In the last 2 years, most courses are in engineering, usually with a concentration in one branch. For example, the last 2 years of an aerospace program might include courses in fluid mechanics, heat transfer, applied aerodynamics, analytical mechanics, flight vehicle design, trajectory dynamics, and aerospace propulsion systems. Some programs offer a general engineering curriculum; students then specialize in graduate school or on the job.

Some engineering schools and 2-year colleges have agreements whereby the 2-year college provides the initial engineering education, and the engineering school automatically admits students for their last 2 years. In addition, a few engineering schools have arrangements whereby a student spends 3 years in a liberal arts college studying pre-engineering subjects and 2 years in an engineering school studying core subjects, and then receives a bachelor's degree from each school. Some colleges and universities offer 5-year master's degree programs. Some 5- or even 6-year cooperative plans combine classroom study and practical work, permitting students to gain valuable experience and finance part of their education. All 50 States and the District of Columbia usually require licensure for engineers who offer their services directly to the public. Engineers who are licensed are called Professional Engineers (PE). This licensure generally requires a degree from an ABET-accredited engineering program, 4 years of relevant work experience, and successful completion of a State examination. Recent graduates can start the licensing process by taking the examination in two stages. The initial Fundamentals of Engineering (FE) examination can be taken upon graduation. Engineers who pass this examination commonly are called Engineers in Training (EIT) or Engineer Interns (EI). The EIT certification usually is valid for 10 years. After acquiring suitable work experience, EITs can take the second examination, the Principles and Practice of Engineering Exam. Several States have imposed mandatory continuing education requirements for relicensure. Most States recognize licensure from other States. Many civil, electrical, mechanical, and chemical engineers are licensed as PEs.

Engineers should be creative, inquisitive, analytical, and detail-oriented. They should be able to work as part of a team and to communicate well, both orally and in writing. Communication abilities are becoming more important because much of their work is becoming more diversified, meaning that engineers interact with specialists in a wide range of fields outside engineering.

Beginning engineering graduates usually work under the supervision of experienced engineers and, in large companies, also may receive formal classroom or seminar-type training. As new engineers gain knowledge and experience, they are assigned more difficult projects with greater independence to develop designs, solve problems, and make decisions. Engineers may advance to become technical specialists or to supervise a staff or team of engineers and technicians. Some may eventually become engineering managers or enter other managerial or sales jobs.

Job Needed: Chefs, Cooks, and Food Preparation Workers

Nature of the Work

A reputation for serving good food is essential to the success of any restaurant or hotel, whether it offers exotic cuisine or hamburgers. Chefs, cooks, and food preparation workers are largely responsible for establishing and maintaining this reputation. Chefs and cooks do this by preparing meals, while other food preparation workers assist them by cleaning surfaces, peeling vegetables, and performing other duties.

In general, *chefs* and *cooks* measure, mix, and cook ingredients according to recipes. In the course of their work they use a variety of pots, pans, cutlery, and other equipment, including ovens, broilers, grills, slicers, grinders, and blenders. Chefs and head cooks often are responsible for directing the work of other kitchen workers, estimating food requirements, and ordering food supplies. Some chefs and head cooks also help plan meals and develop menus.

Large eating places tend to have varied menus and kitchen staffs often include several chefs and cooks, sometimes called assistant or apprentice chefs and cooks, along with other less skilled kitchen workers. Each chef or cook usually has a special assignment and often a special job title—*vegetable, fry, or sauce cook*, for example. Executive chefs and head cooks coordinate the work of the kitchen staff and often direct the preparation of certain foods. They decide the size of servings, plan menus, and buy food supplies. Although the terms chef and cook still are used interchangeably, chefs tend to be more highly skilled and better trained than most cooks. Due to their skillful preparation of traditional dishes and refreshing twists in creating new ones, many chefs have earned fame for both themselves and for the establishments where they work.

The specific responsibilities of most cooks are determined by a number of factors, including the type of restaurant in which they work. *Institution and cafeteria cooks*, for

example, work in the kitchens of schools, cafeterias, businesses, hospitals, and other institutions. For each meal, they prepare a large quantity of a limited number of entrees, vegetables, and desserts. *Restaurant cooks* usually prepare a wider selection of dishes, cooking most orders individually. *Short-order cooks* prepare foods in restaurants and coffee shops that emphasize fast service. They grill and garnish hamburgers, prepare sandwiches, fry eggs, and cook french fries, often working on several orders at the same time. *Fast food cooks* prepare a limited selection of menu items in fast-food restaurants. They cook and package batches of food, such as hamburgers and fried chicken, which are prepared to order or kept warm until sold. *Private household cooks* plan and prepare meals, clean the kitchen, order groceries and supplies, and also may serve meals.

Other food preparation workers, under the direction of chefs and cooks, perform tasks requiring less skill. They weigh and measure ingredients, go after pots and pans, and stir and strain soups and sauces. These workers also clean, peel, and slice vegetables and fruits and make salads. They may cut and grind meats, poultry, and seafood in preparation for cooking. Their responsibilities also include cleaning work areas, equipment, utensils, dishes, and silverware.

The number and types of workers employed in kitchens depends on the type of establishment. For example, fast-food establishments offer only a few items, which are prepared by fast-food cooks. Small, full-service restaurants offering casual dining often feature a limited number of easy-to-prepare items supplemented by short-order specialties and ready-made desserts. Typically, one cook prepares all the food with the help of a short-order cook and one or two other kitchen workers.

Training, Other Qualifications, and Advancement

Most chefs, cooks, and food preparation workers start as fast-food or short-order cooks, or in other lower skilled kitchen positions. These positions require little education or training, and most skills are learned on the job. After acquiring some basic food handling, preparation, and cooking skills, these workers may be able to advance to an assistant cook position.

Although a high school diploma is not required for beginning jobs, it is recommended for those planning a career as a cook or chef. High school or vocational school courses in business arithmetic and business administration are particularly helpful. Many school districts, in cooperation with State departments of education, provide on-the-job training and summer workshops for cafeteria kitchen workers with aspirations of becoming cooks. Large corporations in the food service and hotel industries also offer paid internships and summer jobs, which can provide valuable experience.

To achieve the level of skill required of an executive chef or cook in a fine restaurant, many years of training and experience are necessary. An increasing number of chefs and cooks obtain their training through high school, post-high school vocational programs, or 2- or 4-year colleges. Chefs and cooks also may be trained in apprenticeship programs offered by professional culinary institutes, industry associations, and trade unions. An

example is the 3-year apprenticeship program administered by local chapters of the American Culinary Federation in cooperation with local employers and junior colleges or vocational education institutions. In addition, some large hotels and restaurants operate their own training programs for cooks and chefs.

People who have had courses in commercial food preparation may be able to start in a cook or chef job without having to spend time in a lower skilled kitchen job. Their education may give them an advantage when looking for jobs in better restaurants and hotels, where hiring standards often are high. Although some vocational programs in high schools offer training, employers usually prefer training given by trade schools, vocational centers, colleges, professional associations, or trade unions. Postsecondary courses range from a few months to 2 years or more and are open, in some cases, only to high school graduates. About 8 to 15 years as a cook is required to become a fully qualified chef. Those who gain experience, including in a supervisory capacity, may become executive chefs with responsibility for more than one kitchen. The U.S. Armed Forces also are a good source of training and experience.

Although curricula may vary, students in these programs usually spend most of their time learning to prepare food through actual practice. They learn to bake, broil, and otherwise prepare food, and to use and care for kitchen equipment. Training programs often include courses in menu planning, determination of portion size, food cost control, purchasing food supplies in quantity, selection and storage of food, and use of leftover food to minimize waste. Students also learn hotel and restaurant sanitation and public health rules for handling food. Training in supervisory and management skills sometimes is emphasized in courses offered by private vocational schools, professional associations, and university programs.

Across the nation a number of schools offer culinary courses. The American Culinary Federation has accredited over 100 training programs and offers a number of apprenticeship programs around the country. Typical apprenticeships last three years and combine classroom and work experience. Accreditation is an indication that a culinary program meets recognized standards regarding course content, facilities, and quality of instruction. The American Culinary Federation also certifies pastry professionals, culinary educators, and chefs and cooks at the levels of cook, working chef, executive chef, and master chef. Certification standards are based primarily on experience and formal training. Important characteristics for chefs, cooks, and food preparation workers include the ability to work as part of a team, a keen sense of taste and smell, and personal cleanliness. Most States require health certificates indicating that workers are free from communicable diseases.

Advancement opportunities for chefs and cooks are better than for most other food and beverage preparation and service occupations. Many chefs and cooks acquire high-paying positions and new cooking skills by moving from one job to another. Besides culinary skills, advancement also depends on ability to supervise less skilled workers and limit food costs by minimizing waste and accurately anticipating the amount of perishable supplies needed. Some chefs and cooks go into business as caterers or restaurant owners,

while others become instructors in vocational programs in high schools, community colleges, or other academic institutions. A number of cooks and chefs advance to executive chef positions or supervisory or management positions, particularly in hotels, clubs, and larger, more elegant restaurants.

Job Needed: Waitstaff

Nature of the Work

Whether they work in small, informal diners or large, elegant restaurants, all food and beverage serving and related workers aim to help customers have a positive dining experience in their establishments. These workers greet customers, take food and drink orders, serve food, clean up after patrons, and prepare tables and dining areas.

The largest group of these workers, *waiters and waitresses*, take customers' orders, serve food and beverages, prepare itemized checks, and sometimes accept payments. Their specific duties vary considerably, depending on the establishment where they work. In coffee shops, they are expected to provide fast and efficient, yet courteous service. In fine restaurants, where gourmet meals are accompanied by attentive formal service, waiters and waitresses serve meals at a more leisurely pace and offer more personal service to patrons. For example, servers may recommend a certain wine as a complement to a particular entree, explain how various items on the menu are prepared, or complete preparations on a salad or other special dishes at tableside. Additionally, waiters and waitresses may check the identification of patrons to ensure they meet the minimum age requirement for the purchase of alcohol and tobacco products.

Depending on the type of restaurant, waiters and waitresses may perform additional duties usually associated with other food and beverage service occupations. These tasks may include escorting guests to tables, serving customers seated at counters, setting up and clearing tables, or operating a cash register. However, formal restaurants frequently hire other staff to perform these duties, allowing their waiters and waitresses to concentrate on customer service.

Bartenders fill drink orders that waiters and waitresses take from customers. They prepare standard mixed drinks and, occasionally, are asked to mix drinks to suit a customer's taste. Most bartenders know dozens of drink recipes and are able to mix drinks accurately, quickly, and without waste, even during the busiest periods. Besides mixing and serving drinks, bartenders collect payment, operate the cash register, clean up after customers leave, and often serve food to customers seated at the bar. Bartenders also check identification of customers seated at the bar, to ensure they meet the minimum age requirement for the purchase of alcohol and tobacco products. Bartenders usually are responsible for ordering and maintaining an inventory of liquor, mixes, and other bar supplies. They often form attractive displays out of bottles and glassware and wash the glassware and utensils after each use.

The majority of bartenders who work in eating and drinking establishments directly serve and interact with patrons. Because customers typically frequent drinking establishments for the friendly atmosphere, most bartenders must be friendly and helpful with customers. Bartenders at service bars, on the other hand, have little contact with customers because they work in small bars in restaurants, hotels, and clubs where only waiters and waitresses serve drinks. Some establishments, especially larger ones, use automatic equipment to mix drinks of varying complexity at the push of a button. Even in these establishments, however, bartenders still must be efficient and knowledgeable in case the device malfunctions or a customer requests a drink not handled by the equipment.

Hosts and hostesses try to create a good impression of a restaurant by warmly welcoming guests. Because hosts and hostesses are restaurants' personal representatives, they try to insure that service is prompt and courteous and that the meal meets expectations. They may courteously direct patrons to where coats and other personal items may be left and indicate where patrons can wait until their table is ready. Hosts and hostesses assign guests to tables suitable for the size of their group, escort patrons to their seats, and provide menus. They also schedule dining reservations, arrange parties, and organize any special services that are required. In some restaurants, they also act as cashiers.

Dining room and cafeteria attendants and bartender helpers assist waiters, waitresses, and bartenders by cleaning tables, removing dirty dishes, and keeping serving areas stocked with supplies. They replenish the supply of clean linens, dishes, silverware, and glasses in the dining room and keep the bar stocked with glasses, liquor, ice, and drink garnishes. Bartender helpers also keep bar equipment clean and wash glasses. Dining room attendants set tables with clean tablecloths, napkins, silverware, glasses, and dishes and serve ice water, rolls, and butter. At the conclusion of meals, they remove dirty dishes and soiled linens from tables. Cafeteria attendants stock serving tables with food, trays, dishes, and silverware and may carry trays to dining tables for patrons. *Dishwashers* clean dishes, kitchen and food preparation equipment, and utensils.

Counter attendants take orders and serve food at counters. In cafeterias, they serve food displayed on counters and steam tables, carve meat, dish out vegetables, ladle sauces and soups, and fill beverage glasses. In lunchrooms and coffee shops, counter attendants take orders from customers seated at the counter, transmit orders to the kitchen, and pick up and serve food. They also fill cups with coffee, soda, and other beverages and prepare fountain specialties, such as milkshakes and ice cream sundaes. Counter attendants prepare some short-order items, such as sandwiches and salads, and wrap or place orders in containers for carry out. They also clean counters, write itemized checks, and sometimes accept payment.

Some food and beverage serving workers take orders from customers at counters or drive-through windows at fast-food restaurants. They pick up the ordered beverage and food items, serve them to a customer, and accept payment. Many of these are *combined food preparation and serving workers* who also cook and package food, make coffee, and fill beverage cups using drink-dispensing machines.

Training, Other Qualifications, and Advancement

There are no specific educational requirements for food and beverage service jobs. Although many employers prefer to hire high school graduates for waiter and waitress, bartender, and host and hostess positions, completion of high school usually is not required for fast-food workers, counter attendants, and dining room attendants and bartender helpers. For many people, a job as a food and beverage service worker serves as a source of immediate income, rather than a career. Many entrants to these jobs are in their late teens or early twenties and have a high school education or less. Usually, they have little or no work experience. Many are full-time students or homemakers. Food and beverage service jobs are a major source of part-time employment for high school and college students.

Because maintaining a restaurant's image is important to its success, employers emphasize personal qualities. Food and beverage serving and related workers are in close contact with the public, so these workers should be well spoken and have a neat, clean appearance. They should enjoy dealing with all kinds of people and possess a pleasant disposition.

Waiters and waitresses need a good memory to avoid confusing customers' orders and to recall faces, names, and preferences of frequent patrons. These workers should also be good at arithmetic so they can total bills without the assistance of a calculator or cash register if necessary. In restaurants specializing in foreign foods, knowledge of a foreign language is helpful. Prior experience waiting on tables is preferred by restaurants and hotels that have rigid table service standards. Jobs at these establishments often have higher earnings, but they may also have higher educational requirements than less demanding establishments. Usually, bartenders must be at least 21 years of age, but employers prefer to hire people who are 25 or older. Bartenders should be familiar with State and local laws concerning the sale of alcoholic beverages.

Most food and beverage serving and related workers pick up their skills on the job by observing and working with more experienced workers. Some employers, particularly those in fast-food restaurants, use self-instruction programs with audiovisual presentations and instructional booklets to teach new employees food preparation and service skills. Some public and private vocational schools, restaurant associations, and large restaurant chains provide classroom training in a generalized food service curriculum.

Some bartenders acquire their skills by attending a bartending or vocational and technical school. These programs often include instruction on State and local laws and regulations, cocktail recipes, attire and conduct, and stocking a bar. Some of these schools help their graduates find jobs. Although few employers require any level of educational attainment, some specialized training is usually needed including food handling training and legal issues including serving alcoholic beverages and tobacco. Employers are more likely to hire and promote based on people skills and personal qualities rather than education.

Food and beverage service workers are in close contact with the public, so they should present themselves well and have a neat and clean appearance.

Due to the relatively small size of most food-serving establishments, opportunities for promotion are limited. After gaining some experience, some dining room and cafeteria attendants and bartender helpers are able to advance to waiter, waitress, or bartender jobs. For waiters, waitresses, and bartenders, advancement usually is limited to finding a job in a more expensive restaurant or bar where prospects for tip earnings are better. A few bartenders open their own businesses. Some hosts and hostesses and waiters and waitresses advance to supervisory jobs, such as maitre d', hotel, dining room supervisor, or restaurant manager. In larger restaurant chains, food and beverage service workers who excel at their work often are invited to enter the company's formal management training program.

Job Needed: Janitors

Nature of the Work

Building cleaning workers—which includes janitors, executive housekeepers, and maids and housekeeping cleaners—keep office buildings, hospitals, stores, apartment houses, hotels, and other types of buildings clean and in good condition. Some only do cleaning, while others have a wide range of duties. Janitors and cleaners perform a variety of heavy cleaning duties, such as cleaning floors, shampooing rugs, washing walls and glass, and removing rubbish. They may fix leaky faucets, empty trashcans, do painting and carpentry, replenish bathroom supplies, mow lawns, and see that heating and air-conditioning equipment works properly. On a typical day, janitors may wet- or dry-mop floors, clean bathrooms, vacuum carpets, dust furniture, make minor repairs, and exterminate insects and rodents. They also notify management of the need for repairs and clean snow or debris from sidewalks in front of buildings. Maids and housekeeping cleaners perform any combination of light cleaning duties to maintain private households or commercial establishments, such as hotels, restaurants, and hospitals, in a clean and orderly manner. In hotels, aside from cleaning and maintaining the premises, they may deliver ironing boards, cribs, and rollaway beds to guests' rooms. In hospitals, they also may wash bed frames, brush mattresses, make beds, and disinfect and sterilize equipment and supplies using germicides and sterilizing equipment.

Janitors, maids, and cleaners use various equipment, tools, and cleaning materials. For one job, they may need a mop and bucket; for another, an electric polishing machine and a special cleaning solution. Improved building materials, chemical cleaners, and power equipment have made many tasks easier and less time-consuming, but cleaning workers must learn proper use of equipment and cleaners to avoid harming floors, fixtures, and themselves.

Cleaning supervisors coordinate, schedule, and supervise the activities of janitors and cleaners. They assign tasks and inspect building areas to see that work has been done properly, issue supplies and equipment, inventory stocks to ensure an adequate amount of supplies are present, screen and hire job applicants, and recommend promotions, transfers, or dismissals. They also train new and experienced employees. Supervisors may prepare reports concerning room occupancy, hours worked, and department expenses. Some also perform cleaning duties.

Cleaners and servants in private households dust and polish furniture; sweep, mop, and wax floors; vacuum; and clean ovens, refrigerators, and bathrooms. They also may wash dishes, polish silver, and change and make beds. Some wash, fold, and iron clothes; a few wash windows. General houseworkers also may take clothes and laundry to the cleaners, buy groceries, and do many other errands.

Training, Other Qualifications, and Advancement

No special education is required for most janitorial or cleaning jobs, but beginners should know simple arithmetic and be able to follow instructions. High school shop courses are helpful for jobs involving repair work.

Most building cleaners learn their skills on the job. Usually, beginners work with an experienced cleaner, doing routine cleaning. As they gain more experience, they are assigned more complicated tasks. In some cities, programs run by unions, government agencies, or employers teach janitorial skills. Students learn how to clean buildings thoroughly and efficiently, how to select and safely use various cleansing agents, and how to operate and maintain machines, such as wet and dry vacuums, buffers, and polishers. Students learn to plan their work, to follow safety and health regulations, to interact positively with people in the buildings they clean, and to work without supervision. Instruction in minor electrical, plumbing, and other repairs also may be given. Those who come in contact with the public should have good communication skills. Employers usually look for dependable, hard-working individuals who are in good health, follow directions well, and get along with other people.

Building cleaners usually find work by answering newspaper advertisements, applying directly to organizations where they would like to work, contacting local labor unions, or contacting State employment service offices.

Advancement opportunities for workers usually are limited in organizations where they are the only maintenance worker. Where there is a large maintenance staff, however, cleaning workers can be promoted to supervisor and to area supervisor or manager. A high school diploma improves the chances for advancement. Some janitors set up their own maintenance business. Supervisors usually move up through the ranks. In many establishments, they are required to take some in-service training to improve their housekeeping techniques and procedures, and to enhance their supervisory skills.

A small number of cleaning supervisors and managers are members of the International Executive Housekeepers Association (IEHA). IEHA offers two kinds of certification programs to cleaning supervisors and managers—Certified Executive Housekeeper (CEH) and Registered Executive Housekeeper (REH). The CEH designation is offered to those with a high school education, while the REH designation is offered to those who have a 4-year college degree. Both designations are earned by attending courses and passing exams, and must be renewed every 2 years to ensure that workers keep abreast of new cleaning methods. Those with the REH designation usually oversee the cleaning services of hotels, hospitals, casinos, and other large institutions that rely on well-trained experts for their cleaning needs.

Job Needed: Legal Assistants

Nature of the Work

While lawyers assume ultimate responsibility for legal work, they often delegate many of their tasks to paralegals. In fact, paralegals—also called legal assistants—continue to assume a growing range of tasks in the Nation's legal offices and perform many of the same tasks as lawyers. Nevertheless, they are still explicitly prohibited from carrying out duties which are considered to be the practice of law, such as setting legal fees, giving legal advice, and presenting cases in court.

One of a paralegal's most important tasks is helping lawyers prepare for closings, hearings, trials, and corporate meetings. Paralegals investigate the facts of cases and ensure that all relevant information is considered. They also identify appropriate laws, judicial decisions, legal articles, and other materials that are relevant to assigned cases. After they analyze and organize the information, paralegals may prepare written reports that attorneys use in determining how cases should be handled. Should attorneys decide to file lawsuits on behalf of clients, paralegals may help prepare the legal arguments, draft pleadings and motions to be filed with the court, obtain affidavits, and assist attorneys during trials. Paralegals also organize and track files of all important case documents and make them available and easily accessible to attorneys.

In addition to this preparatory work, paralegals also perform a number of other vital functions. For example, they help draft contracts, mortgages, separation agreements, and trust instruments. They also may assist in preparing tax returns and planning estates. Some paralegals coordinate the activities of other law office employees and maintain financial office records. Various additional tasks may differ, depending on the employer.

Paralegals are found in all types of organizations, but most are employed by law firms, corporate legal departments, and various government offices. In these organizations, they may work in all areas of the law, including litigation, personal injury, corporate law, criminal law, employee benefits, intellectual property, labor law, bankruptcy, immigration, family law, and real estate. Within specialties, functions often are broken down further so that paralegals may deal with a specific area. For example, paralegals specializing in labor law may deal exclusively with employee benefits.

The duties of paralegals also differ widely based on the type of organization in which they are employed. Paralegals who work for corporations often assist attorneys with employee contracts, shareholder agreements, stock-option plans, and employee benefit plans. They also may help prepare and file annual financial reports, maintain corporate minute books and resolutions, and secure loans for the corporation. Paralegals often monitor and review government regulations to ensure that the corporation operates within the law.

The duties of paralegals who work in the public sector usually vary within each agency. In general, they analyze legal material for internal use, maintain reference files, conduct

research for attorneys, and collect and analyze evidence for agency hearings. They may then prepare informative or explanatory material on laws, agency regulations, and agency policy for general use by the agency and the public. Paralegals employed in community legal-service projects help the poor, the aged, and others in need of legal assistance. They file forms, conduct research, prepare documents, and when authorized by law, may represent clients at administrative hearings.

Paralegals in small and medium-sized law firms usually perform a variety of duties that require a general knowledge of the law. For example, they may research judicial decisions on improper police arrests or help prepare a mortgage contract. Paralegals employed by large law firms, government agencies, and corporations, however, are more likely to specialize in one aspect of the law.

Computer use and technical knowledge has become essential to paralegal work. Computer software packages and the Internet are increasingly used to search legal literature stored in computer databases and on CD-ROM. In litigation involving many supporting documents, paralegals may use computer databases to retrieve, organize, and index various materials. Imaging software allows paralegals to scan documents directly into a database, while billing programs help them to track hours billed to clients. Computer software packages also may be used to perform tax computations and explore the consequences of possible tax strategies for clients.

Training, Other Qualifications, and Advancement

There are several ways to become a paralegal. Employers usually require formal paralegal training obtained through associate or bachelor's degree programs or through a certification program. Increasingly, employers prefer graduates of 4-year paralegal programs or college graduates who have completed paralegal certificate programs. Some employers prefer to train paralegals on the job, hiring college graduates with no legal experience or promoting experienced legal secretaries. Other entrants have experience in a technical field that is useful to law firms, such as a background in tax preparation for tax and estate practice, or nursing or health administration for personal injury practice.

Over 800 formal paralegal training programs are offered by 4-year colleges and universities, law schools, community and junior colleges, business schools, and proprietary schools. There are currently 247 programs approved by the American Bar Association (ABA). Although this approval is neither required nor sought by many programs, graduation from an ABA-approved program can enhance one's employment opportunities. The requirements for admission to these programs vary. Some require certain college courses or a bachelor's degree; others accept high school graduates or those with legal experience; and a few schools require standardized tests and personal interviews.

Paralegal programs include 2-year associate's degree programs, 4-year bachelor's degree programs, and certificate programs that take only a few months to complete. Many certificate programs only require a high school diploma or GED for admission, but they

usually are designed for students who already hold an associate or baccalaureate degree. Programs typically include courses on law and legal research techniques, in addition to courses covering specialized areas of law, such as real estate, estate planning and probate, litigation, family law, contracts, and criminal law. Many employers prefer applicants with specialized training.

The quality of paralegal training programs varies; the better programs usually include job placement. Programs increasingly include courses introducing students to the legal applications of computers. Many paralegal training programs include an internship in which students gain practical experience by working for several months in a private law firm, office of a public defender or attorney general, bank, corporate legal department, legal-aid organization, or government agency. Experience gained in internships is an asset when seeking a job after graduation. Prospective students should examine the experiences of recent graduates before enrolling in those programs.

Although most employers do not require certification, earning a voluntary certificate from a professional society may offer advantages in the labor market. The National Association of Legal Assistants, for example, has established standards for certification requiring various combinations of education and experience. Paralegals who meet these standards are eligible to take a 2-day examination, given three times each year at several regional testing centers. Those who pass this examination may use the designation Certified Legal Assistant (CLA). In addition, the Paralegal Advanced Competency Exam, established in 1996 and administered through the National Federation of Paralegal Associations, offers professional recognition to paralegals with a bachelor's degree and at least 2 years of experience. Those who pass this examination may use the designation Registered Paralegal (RP).

Paralegals must be able to document and present their findings and opinions to their supervising attorney. They need to understand legal terminology and have good research and investigative skills. Familiarity with the operation and applications of computers in legal research and litigation support also is increasingly important. Paralegals should stay informed of new developments in the laws that affect their area of practice. Participation in continuing legal education seminars allows paralegals to maintain and expand their legal knowledge.

Because paralegals frequently deal with the public, they should be courteous and uphold the ethical standards of the legal profession. The National Association of Legal Assistants, the National Federation of Paralegal Associations, and a few States have established ethical guidelines for paralegals to follow.

Paralegals usually are given more responsibilities and less supervision as they gain work experience. Experienced paralegals who work in large law firms, corporate legal departments, and government agencies may supervise and delegate assignments to other paralegals and clerical staff. Advancement opportunities also include promotion to managerial and other law-related positions within the firm or corporate legal department.

However, some paralegals find it easier to move to another law firm when seeking increased responsibility or advancement.

Job Needed: Basic Clerical Assistants

Nature of the Work

Receptionists and information clerks are charged with a responsibility that may have a lasting impact on the success of an organization—making a good first impression. These workers often are the first representatives of an organization a visitor encounters, so they need to be courteous, professional, and helpful. Receptionists answer telephones, route calls, greet visitors, respond to inquiries from the public and provide information about the organization. In addition, receptionists contribute to the security of an organization by helping to monitor the access of visitors.

Whereas some tasks are common to most receptionists and information clerks, the specific responsibilities of receptionists vary depending upon the type of establishment in which they work. For example, receptionists in hospitals and doctors' offices may gather personal and financial information and direct patients to the proper waiting rooms. In beauty or hair salons, however, they arrange appointments, direct customers to the hairstylist, and may serve as cashier. In factories, large corporations, and government offices, they may provide identification cards and arrange for escorts to take visitors to the proper office. Those working for bus and train companies respond to inquiries about departures, arrivals, stops, and other related matters.

Increasingly, receptionists use multi-line telephone systems, personal computers, and fax machines. Despite the widespread use of automated answering systems or voice mail, many receptionists still take messages and inform other employees of visitors' arrivals or cancellation of an appointment. When they are not busy with callers, most receptionists are expected to perform a variety of office duties including opening and sorting mail, collecting and distributing parcels, making fax transmittals and deliveries, updating appointment calendars, preparing travel vouchers, and performing basic bookkeeping, word processing, and filing.

The amount of information generated by organizations continues to grow rapidly. File clerks classify, store, retrieve, and update this information. In many small offices, they often have additional responsibilities, such as data entry, word processing, sorting mail, and operating copying or fax machines. They are employed across the Nation by organizations of all types.

File clerks, also called records, information, or record center clerks, examine incoming material and code it numerically, alphabetically, or by subject matter. They then store forms, letters, receipts, or reports in paper form or enter necessary information into other storage devices. Some clerks operate mechanized files that rotate to bring the needed

records to them; others convert documents to films that are then stored on microforms, such as microfilm or microfiche. A growing number of file clerks use imaging systems that scan paper files or film and store the material on optical disks.

In order for records to be useful they must be up-to-date and accurate. File clerks ensure that new information is added to the files in a timely manner and may get rid of outdated file materials or transfer them to inactive storage. They also check files at regular intervals to make sure that all items are correctly sequenced and placed. Whenever records cannot be found, the file clerk attempts to locate the missing material. As an organization's needs for information change, file clerks also implement changes to the filing system established by supervisory personnel.

When records are requested, file clerks locate them and give them to the borrower. The record may be a sheet of paper stored in a file cabinet or an image on microform. In the first example, the clerk manually retrieves the document and hands or forwards it to the borrower. In the latter example, the clerk retrieves the microform and displays it on a microform reader. If necessary, file clerks make copies of records and distribute them. In addition, they keep track of materials removed from the files to ensure that borrowed files are returned.

Increasingly, file clerks use computerized filing and retrieval systems. These systems use a variety of storage devices, such as a mainframe computer, CD-ROM, or floppy disk. To retrieve a document in these systems, the clerk enters the document's identification code, obtains the location, and pulls the document. Accessing files in a computer database is much quicker than locating and physically retrieving paper files. Even when files are stored electronically, however, backup paper or electronic copies usually are also kept.

Training, Other Qualifications, and Advancement

Although hiring requirements for information and record clerk jobs vary from industry to industry, a high school diploma or its equivalent is the most common educational requirement. Increasingly, familiarity or experience with computers and good interpersonal skills often are equally important to employers. Although many employers prefer to hire information and record clerks with a higher level of education, it is only required in a few of these clerical occupations. For example, brokerage firms usually seek college graduates for brokerage clerk jobs, and order clerks in high-technology firms often need to understand scientific and mechanical processes, which may require some college education. For customer service representatives, new account clerks, and airline reservation and ticket agent jobs, some college education may be preferred.

Many information clerks deal directly with the public, so a professional appearance and pleasant personality are important. A clear speaking voice and fluency in the English language also are essential because these employees frequently use the telephone or public address systems. Good spelling and computer literacy often are needed, particularly because most work involves considerable computer use. It also is

increasingly helpful for those wishing to enter the lodging or travel industries to speak a foreign language fluently.

With the exception of airline reservation and transportation ticket agents, orientation and training for information clerks usually takes place on the job. For example, orientation for hotel and motel desk clerks usually includes an explanation of the job duties and information about the establishment, such as room locations and available services. New employees learn job tasks through on-the-job training under the guidance of a supervisor or an experienced clerk. They often need additional training in how to use the computerized reservation, room assignment, and billing systems and equipment. Most clerks continue to receive instruction on new procedures and company policies after their initial training ends.

Receptionists usually receive on-the-job training which may include procedures for greeting visitors, operating telephone and computer systems, and distributing mail, fax, and parcel deliveries. Some employers look for applicants who already possess certain skills, such as prior computer and word processing experience, or previous formal education. Customer service representatives also receive on-the-job training, which includes instructions on how to operate telephone and computer systems. These workers must possess strong communication skills since they are constantly interacting with customers.

Record clerks often learn the skills they need in high schools, business schools, and community colleges. Business education programs offered by these institutions typically include courses in typing, word processing, shorthand, business communications, records management, and office systems and procedures. Specialized order clerks in technical positions obtain their training from technical institutes and 2- and 4-year colleges.

Some entry-level record clerks are college graduates with degrees in business, finance, or liberal arts. Although a degree rarely is required, many graduates accept entry-level clerical positions to get into a particular company or to enter a particular field. Some companies, such as brokerage and accounting firms, have a set plan of advancement that tracks college graduates from entry-level clerical jobs into managerial positions. Workers with college degrees are likely to start at higher salaries and advance more easily than those without degrees.

Once hired, record clerks usually receive on-the-job training. Under the guidance of a supervisor or other senior workers, new employees learn company procedures. Some formal classroom training also may be necessary, such as training in specific computer software.

Advancement for information and record clerks usually comes by transfer to a position with more responsibilities or by promotion to a supervisory position. Most companies fill office and administrative support supervisory and managerial positions by promoting individuals within their organization, so information clerks who acquire additional skills, experience, and training improve their advancement opportunities. Receptionists,

interviewers, and new account clerks with word processing or other clerical skills may advance to a better paying job as a secretary or administrative assistant. Within the airline industry, a ticket agent may advance to lead worker on the shift.

Job Needed: Plumbers

Nature of the Work

Plumbers use many different materials and construction techniques, depending on the type of project. Residential water systems, for example, incorporate copper, steel, and plastic pipe that can be handled and installed by one or two workers. Despite these differences, all plumbers must be able to follow building plans or blueprints and instructions from supervisors, lay out the job, and work efficiently with the materials and tools of the trade. Computers often are used to create blueprints and plan layouts.

When construction plumbers install piping in a house, for example, they work from blueprints or drawings that show the planned location of pipes, plumbing fixtures, and appliances. They first lay out the job to fit the piping into the structure of the house with the least waste of material and within the confines of the structure. They then measure and mark areas in which pipes will be installed and connected. Construction plumbers also check for obstructions such as electrical wiring and, if necessary, plan the pipe installation around the problem.

Sometimes, plumbers have to cut holes in walls, ceilings, and floors of a house. For some systems, they may hang steel supports from ceiling joists to hold the pipe in place. To assemble a system, plumbers—using saws, pipe cutters, and pipe-bending machines—cut and bend lengths of pipe. They connect lengths of pipe with fittings, using methods that depend on the type of pipe used. For plastic pipe, plumbers connect the sections and fittings with adhesives. For copper pipe, they slide a fitting over the end of the pipe and solder it in place with a torch.

After the piping is in place in the house, plumbers install the fixtures and appliances and connect the system to the outside water or sewer lines. Finally, using pressure gauges, they check the system to ensure that the plumbing works properly.

Training, Other Qualifications, and Advancement

Virtually all, plumbers, undergo some type of apprenticeship training. Many programs are administered by local union-management committees made up of members of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada, and local employers who are members of the Mechanical Contractors Association of America, the National Association of Plumbing-Heating-Cooling Contractors, or the National Fire Sprinkler Association. Nonunion training and apprenticeship programs are administered by local chapters of the

Associated Builders and Contractors, the National Association of Plumbing-Heating-Cooling Contractors, the American Fire Sprinkler Association, or the Home Builders Institute of the National Association of Home Builders.

Apprenticeships—both union and nonunion—consist of 4 or 5 years of on-the-job training, in addition to at least 144 hours per year of related classroom instruction. Classroom subjects include drafting and blueprint reading, mathematics, applied physics and chemistry, safety, and local plumbing codes and regulations. On the job, apprentices first learn basic skills, such as identifying grades and types of pipe, using the tools of the trade, and safely unloading materials. As apprentices gain experience, they learn how to work with various types of pipe and how to install different piping systems and plumbing fixtures. Apprenticeship gives trainees a thorough knowledge of all aspects of the trade. Although most pipelayers, plumbers, pipefitters, and steamfitters are trained through apprenticeship, some still learn their skills informally on the job.

Applicants for union or nonunion apprentice jobs must be at least 18 years old and in good physical condition. Apprenticeship committees may require applicants to have a high school diploma or its equivalent. Armed Forces training in pipelaying, plumbing, and pipefitting is considered very good preparation. In fact, persons with this background may be given credit for previous experience when entering a civilian apprenticeship program. Secondary or postsecondary courses in shop, plumbing, general mathematics, drafting, blueprint reading, computers, and physics also are good preparation.

Although there are no uniform national licensing requirements, most communities require plumbers to be licensed. Licensing requirements vary from area to area, but most localities require workers to pass an examination that tests their knowledge of the trade and of local plumbing codes.

Some pipelayers, plumbers, pipefitters, and steamfitters may become supervisors for mechanical and plumbing contractors; others go into business for themselves.

Job Needed: Scientists

Nature of the Work

Everything in the environment, whether naturally occurring or of human design, is composed of chemicals. Chemists and materials scientists search for and use new knowledge about chemicals. Chemical research has led to the discovery and development of new and improved synthetic fibers, paints, adhesives, drugs, cosmetics, electronic components, lubricants, and thousands of other products. Chemists and materials scientists also develop processes that save energy and reduce pollution, such as improved oil refining and petrochemical processing methods. Research on the chemistry of living things spurs advances in medicine, agriculture, food processing, and other fields.

Materials scientists research and study the structures and chemical properties of various materials to develop new products or enhance existing ones. They also determine ways to strengthen or combine materials or develop new materials for use in a variety of products. Materials science encompasses the natural and synthetic materials used in a wide range of products and structures, from airplanes, cars, and bridges to clothing and household goods. Companies whose products are made of metals, ceramics, and rubber employ most material scientists. Other applications of this field include studies of superconducting materials, graphite materials, integrated-circuit chips, and fuel cells. Materials scientists, applying chemistry and physics, study all aspects of these materials. Chemistry plays an increasingly dominant role in materials science, because it provides information about the structure and composition of materials.

Many chemists and materials scientists work in research and development (R&D). In basic research, they investigate properties, composition, and structure of matter and the laws that govern the combination of elements and reactions of substances. In applied R&D, they create new products and processes or improve existing ones, often using knowledge gained from basic research. For example, synthetic rubber and plastics resulted from research on small molecules uniting to form large ones, a process called polymerization. R&D chemists and material scientists use computers and a wide variety of sophisticated laboratory instrumentation for modeling and simulation in their work.

The use of computers to analyze complex data has had the dramatic impact of allowing chemists and materials scientists to practice combinatorial chemistry. This technique makes and tests large quantities of chemical compounds simultaneously in order to find compounds with desired properties. As an integral part of drug and materials discovery, combinatorial chemistry speeds up material designing and research and development, permitting useful compounds to be developed more quickly and inexpensively than was formerly possible. Combinatorial chemistry has allowed chemists to produce thousands of compounds each year and to assist in the completion of sequencing human genes.

Chemists also work in production and quality control in chemical manufacturing plants. They prepare instructions for plant workers that specify ingredients, mixing times, and temperatures for each stage in the process. They also monitor automated processes to

ensure proper product yield, and test samples of raw materials or finished products to ensure that they meet industry and government standards, including the regulations governing pollution. Chemists report and document test results and analyze those results in hopes of further improving existing theories or developing new test methods.

Chemists often specialize in a subfield. *Analytical chemists* determine the structure, composition, and nature of substances by examining and identifying the various elements or compounds that make up a substance. They are absolutely crucial to the pharmaceutical industry because pharmaceutical companies need to know the identity of compounds that they hope to turn into drugs. Furthermore, they study the relations and interactions of the parts of compounds and develop analytical techniques. They also identify the presence and concentration of chemical pollutants in air, water, and soil. *Organic chemists* study the chemistry of the vast number of carbon compounds that make up all living things. Organic chemists who synthesize elements or simple compounds to create new compounds or substances that have different properties and applications have developed many commercial products, such as drugs, plastics, and elastomers (elastic substances similar to rubber). *Inorganic chemists* study compounds consisting mainly of elements other than carbon, such as those in electronic components. *Physical and theoretical chemists* study the physical characteristics of atoms and molecules and the theoretical properties of matter, and investigate how chemical reactions work. Their research may result in new and better energy sources. *Macromolecular chemists* study the behavior of atoms and molecules. *Medicinal chemists* study the structural properties of compounds intended for applications to human medicine. *Materials chemists* study and develop new materials to improve existing products or make new ones. In fact, virtually all chemists are involved in this quest in one way or another. Developments in the field of chemistry that involve life sciences will expand, resulting in more interaction between biologists and chemists. (*Biochemists*, whose work encompasses both biology and chemistry, are discussed in the *Handbook* statement on biological scientists).

Materials scientists also may specialize in specific areas such as ceramics or metals.

Training, Other Qualifications, and Advancement

A bachelor's degree in chemistry or a related discipline is usually the minimum educational requirement for entry-level chemist jobs. However, many research jobs require a Ph.D. While some materials scientists hold a degree in materials science, a bachelor's degree in chemistry, physics, or electric engineering also is accepted. For research and development jobs, a Ph.D. in materials science or a related science is often required. Many colleges and universities offer a bachelor's degree program in chemistry; about 620 are approved by the American Chemical Society (ACS). The number of colleges that offer a degree program in materials science is small, but gradually increasing. Several hundred colleges and universities also offer advanced degree programs in chemistry; around 320 master's programs, and about 190 doctoral programs are ACS-approved.

Students planning careers as chemists and materials scientists should take courses in science and mathematics, and should like working with their hands building scientific apparatus and performing laboratory experiments and computer modeling. Perseverance, curiosity, and the ability to concentrate on detail and to work independently are essential. Interaction among specialists in this field is increasing, especially for chemists in drug development. One type of chemist often relies on the findings of another type of chemist. For example, an organic chemist must understand findings on the identity of compounds prepared by an analytical chemist.

In addition to required courses in analytical, inorganic, organic, and physical chemistry, undergraduate chemistry majors usually study biological sciences, mathematics, and physics. Those interested in the environmental field should also take courses in environmental studies and become familiar with current legislation and regulations. Computer courses are essential, as employers increasingly prefer job applicants who are able to apply computer skills to modeling and simulation tasks and operate computerized laboratory equipment. This is increasingly important as combinatorial chemistry techniques are more widely applied. Scientists with outdated skills or who are unfamiliar with combinatorial chemistry are often retrained by companies in-house.

Because research and development chemists and materials scientists are increasingly expected to work on interdisciplinary teams, some understanding of other disciplines, including business and marketing or economics, is desirable, along with leadership ability and good oral and written communication skills. Experience, either in academic laboratories or through internships, fellowships, or co-op programs in industry, also is useful. Some employers of research chemists, particularly in the pharmaceutical industry, prefer to hire individuals with several years of postdoctoral experience.

Graduate students typically specialize in a subfield of chemistry, such as analytical chemistry or polymer chemistry, depending on their interests and the kind of work they wish to do. For example, those interested in doing drug research in the pharmaceutical industry usually develop a strong background in synthetic organic chemistry. However, students normally need not specialize at the undergraduate level. In fact, undergraduates who are broadly trained have more flexibility when job hunting or changing jobs than if they narrowly define their interests. Most employers provide new graduates additional training or education.

In government or industry, beginning chemists with a bachelor's degree work in quality control, perform analytical testing, or assist senior chemists in research and development laboratories. Many employers prefer chemists and material scientists with a Ph.D. or at least a master's degree to lead basic and applied research. Nonetheless, relevant work experience is an asset. Chemists who hold a Ph.D. and have previous industrial experience may be particularly attractive to employers because such people are more likely to understand the complex regulations that apply to the pharmaceutical industry. Within materials science, a broad background in various sciences is preferred. This broad base may be obtained through degrees in physics, engineering, or chemistry. While many companies prefer hiring Ph.D.'s, many materials scientists have bachelor's and master's

degrees. Additionally, both chemists and materials scientists need the ability to apply basic statistical techniques.

Job Needed: Environmental Engineers

Nature of the Work

Using the principles of biology and chemistry, environmental engineers develop methods to solve problems related to the environment. They are involved in water and air pollution control, recycling, waste disposal, and public health issues. Environmental engineers conduct hazardous-waste management studies, evaluate the significance of the hazard, offer analysis on treatment and containment, and develop regulations to prevent mishaps. They design municipal sewage and industrial wastewater systems. They analyze scientific data, research controversial projects, and perform quality control checks.

Environmental engineers are concerned with local and worldwide environmental issues. They study and attempt to minimize the effects of acid rain, global warming, automobile emissions, and ozone depletion. They also are involved in the protection of wildlife. Many environmental engineers work as consultants, helping their clients comply with regulations and clean up hazardous sites, including brownfields, which are abandoned urban or industrial sites that may contain environmental hazards.

Training, Other Qualifications, and Advancement

The career track for this job is nearly identical to those of other engineering disciplines described elsewhere in this appendix.
