The Working Poor Families Project

POLICY BRIEF
FALL 2008

Preparing Low-Skilled Workers for the Jobs of Tomorrow

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U.S. companies grow and create jobs when they effectively compete in a global market. Increasingly, success is driven by innovations that generate new products or services, deploy new technologies, or provide products or services in new ways.

Given that innovation is seen as the core of economic success, it should come as little surprise that state economic development leaders are focusing a great deal of resources and attention on strategies designed to promote new technology development and adoption. These strategies can focus on the fields of science, technology, engineering, and math (STEM) and include efforts to generate more high-level college graduates in these areas. Examples of state initiatives include major life sciences programs in Washington and Indiana, renewable energy initiatives in Iowa and California, and broad-based technology initiatives in Arizona and Arkansas.

While these efforts may very well stimulate new and innovative economic activity, they just as importantly may increase job growth across a broad spectrum of occupations. However, many efforts focus solely on generating more high-skill scientists, engineers and senior-level managers to the exclusion of a wide variety of middle-skilled, support and technical occupations -- the occupations that are the backbone of innovation.[3] Moreover, those jobs are within the grasp of people with less than a four-year degree. The workforce challenge is how best to upgrade existing worker skills to meet these opportunities.

The **Working Poor Families Project (WPFP)** supports the efforts of nonprofit organizations to strengthen state policies that can assist low-income workers seeking to achieve economic security and become productive participants in the economy. WPFP encourages state groups to better understand the linkages between technology-based economic development and education and skills development for existing workers. This brief first examines the critical role that technology industries play in developing new economies and describes the importance of workers engaged in STEM occupations.[4] The brief also identifies how state policies can better prepare today's existing low-skilled workers for middle-skill and technical STEM positions. With the right kind of supporting policy tools, states can leverage growth in technology industries and STEM-based jobs to assist existing low-skill workers access these opportunities.

THE WORKING POOR FAMILIES PROJECT

Strengthening State Policies for America's Working Poor

Millions of American breadwinners work hard to support their families. But, despite their determination and effort, many are mired in low-wage jobs that provide inadequate benefits and offer few opportunities for advancement. In fact, more than one out of four American working families now earn wages so low that they have difficulty surviving financially.[2]

Launched in 2002 and currently supported by the Annie E. Casey, Ford, Joyce, and Mott foundations, the Working Poor Families Project is a national initiative that works to improve these economic conditions. The project partners with state nonprofit organizations and supports their policy efforts to better prepare America's working families for a more secure economic future.

For more information:
http://www.workingpoorfamilies.org

State investments in technology-based economic development (TBED) have revealed the need to increase STEM-related skills in the workforce. Primarily, these state efforts have focused on increasing access to four-year science and math education and improving the science and math foundation of K-12 students; the goal being to increase the number of "typical" idea creators – scientists and engineers. Certainly these high-skilled workers are important to business success, but companies also require technicians, inspectors, administrative staff, and an array of other support occupations that do not require four-year or advanced degrees.[5] For every ten architects and engineers, there are nearly eight middle-skill jobs for administrative support personnel, technicians, installers, maintenance personnel, or production workers in the architecture and engineering fields.[6] In the research and development field, every researcher and scientist requires another 1.6 persons working in related support occupations (including related administrative support, technical, equipment maintenance and installation workers). To implement successful TBED strategies, states will need to ensure that businesses, non-profits, and government enterprises have access to skilled technical workers at all levels.

Technology Industries - An Occupational Perspective[7]

States are increasingly engaging in technology-based economic development, which involves a wide variety of activities including initiatives that:

- Promote new discovery and knowledge creation with an emphasis on commercial applications,
- Transfer knowledge from one individual or company to another,
- Facilitate the development of the physical infrastructure required for knowledge transfer (e.g., broadband telecommunications)
- Educate and train the highly skilled, technical people needed to create and utilize these new discoveries, particularly for STEM related occupations, as well as
- Leverage the risk capital necessary for business investment.

Governors and state legislatures are investing hundreds of millions of tax dollars in these TBED initiatives. Recent examples include Arizona's 21st Century Fund, Florida's Opportunity Fund, Washington's Life Sciences Discovery Fund, and Iowa's Power Fund. In 2007 alone, states invested more than $1.5 billion in newly appropriated funds for TBED-related activities in tight fiscal times.[8]

In general, TBED initiatives aim to help build a next-generation economy in states once dependent on mature, declining industries or highly cyclical ones. Many policymakers are particularly concerned whether their states have the talent needed to grow and support these initiatives.

While health care is probably one of the most highly visible and fastest growing careers, the US Bureau of Labor Statistics' primary data source of careers (O*Net -- http://online.onetcenter.org/) does not include these careers as STEM-related. Even if one argues this technical definition, health care is rarely the focus of statewide technology-based economic development strategies. For that reason, this paper does not include health care occupations as integral to the talent needs required for State technology-based economic development initiatives even though these careers offer many important occupational opportunities for lower skilled workers.

In most state TBED initiatives, the focus has been largely targeted to STEM careers in research related to the life and physical sciences, particularly those requiring four-year or advanced degrees. However,

Figure 1: The Intersection of Technology Industries and STEM Occupations

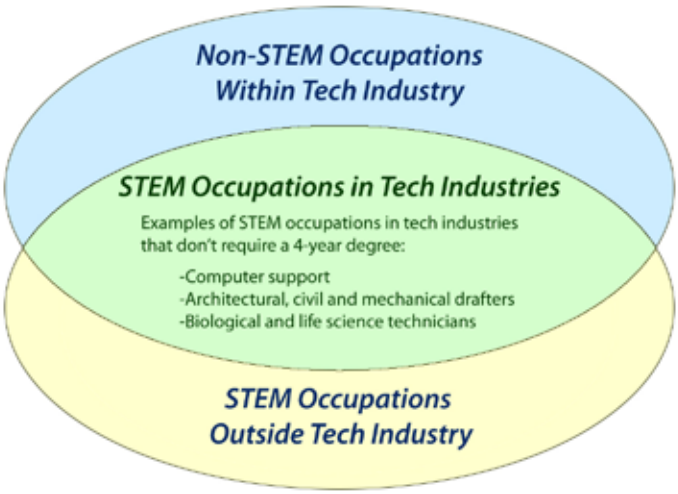


Figure 2: Tech Industry Employment

Minimum Education Requirement	Estimated Emp 2008	Net New Jobs (03-08)	Median Earnings* 2007	Entry Level Earnings 2007	% Total Emp (2008)	% New Jobs (08-18)
Baccalaureate or higher	8,032,943	920,763	$34.03	$16.41	45.9%	68.4%
Associate or other postsecondary	1,796,265	114,518	$22.93	$11.67	10.3%	8.5%
Work experience in field	1,320,716	94,804	$35.94	$13.17	7.5%	7.0%
Moderate & Long OJT (greater than 1 month)	4,259,077	187,857	$20.90	$10.24	24.3%	14.0%
Short-term training	2,085,595	28,688	$12.67	$7.06	11.9%	2.1%
Total: Tech Industries	17,494,596	1,346,630	$27.29	$10.82	100.0%	100.0%

Source: EMSI; Prepared by CREC **Earnings = wages plus benefits*

many technology industries[9] also offer good paying jobs in STEM related occupations that require two years of post-secondary education or less. Figure 1 illustrates that tech-dependent industries and STEM-related jobs can offer family-sustaining wages to adults who do not have a four-year college degree.

Many would be surprised to learn that about 54 percent of jobs in today's technology industries (including both STEM and non-STEM related jobs) do not require a four-year degree. In fact, 36 percent of the jobs in these industries can be accomplished through on-the-job training combined with a high school degree. As Figure 2 illustrates, however, the lower skill jobs in technology industries are not growing as rapidly as careers requiring at least a year or more of post-secondary education or training.

Entry level jobs in the tech sector pay about the same on average as jobs in the rest of the economy. These positions, however, offer a much greater opportunity for advancement to higher paying positions. The median earnings in technology industries are approximately 49 percent higher than jobs in in other parts of the economy. This suggests that success in technology careers depends both on gaining the education and skills needed to enter the field as well as on gaining work experience. The rapid rise in income for technology workers also implies that they have obtained the skills necessary to handle continuous change in fast growing companies.

Direct Opportunities in STEM Careers

Many jobs available in technology-based industries require skills in STEM academic disciplines. STEM-related occupations are those that the U.S. Bureau of Labor Statistics (BLS) has defined as tied to science (in the form of scientists and technicians), technology (primarily in the form of computing-related occupations), engineering (engineering and drafting occupations of all kinds), and mathematical sciences (including statisticians and accounting). As noted earlier, these do not include careers in health care therapeutics or related health information management, but they do include careers in medical research.

Through O*Net, the U.S. Department of Labor has identified nearly 100 specific occupations related to seven STEM disciplines – computer science, engineering, environmental science, geosciences, life sciences, mathematics, and physics/astronomy. Occupations may be assigned to multiple disciplines, reflecting the overlap and convergence of many STEM-related activities.

Using the BLS definition, the U.S. economy has about 15.6 million jobs in STEM-related careers (see Figure 3). Of that total, about 5.3 million (or 34 percent) are in occupations that do not require a baccalaureate degree. However, about 24 percent of the 311,000 STEM jobs created within the past five years require an associate degree or less.

Figure 3: Employment in STEM Occupations

Minimum Education Requirement	Estimated Emp 2008	Net New Jobs (03-08)	Median Earnings* 2007	Entry Level Earnings 2007	% Total Emp (2008)	% New Jobs (08-18)
Baccalaureate or higher	8,032,943	229,147	$32.86	$19.00	65.7%	73.7%
Associate or other postsecondary	2,867,678	40,122	$21.36	$12.23	18.4%	12.9%
Work experience in field	1,230,162	27,102	$16.28	$9.79	7.9%	8.7%
Moderate & Long OJT (greater than 1 month)	1,100,796	13,844	$15.25	$9.51	7.0%	4.5%
Short-term training	164,749	743	$13.08	$8.37	1.1%	0.2%
Total: Tech Industries	15,623,434	310,957	$27.97	$16.24	100.0%	100.0%

Source: EMSI; Prepared by CREC **Earnings = wages plus benefits*

Of the technology industries occupations that were STEM-related but did not require a four-year college degree, 15 added more than 1,000 jobs nationally between 2003 and 2008 (see Figure 4). All of these occupations required some education or training beyond high school, including vocational certifications or associate's degrees in related STEM disciplines. By far, the largest of these occupations were directly related to computer support or troubleshooting. In addition, many of the other occupations required significant computer skills, including surveying and mapping technician as well as architectural drafting occupations.

Figure 4: Fastest Growing Tech Industry STEM Occupations That Do Not Require a BA/BS, 2003-2008

Occupation Description	National 2008 Jobs	2003-2008 Change	Annual % Change	Annual New and Replacement Jobs, US	Minimum Education Requirement
Computer support specialist	265,313	18,954	1.5%	13,605	Associate's degree
Computer specialists, all other	159,038	14,360	1.9%	7,374	Associate's degree
Surveying and mapping technician	70,128	10,998	3.5%	2,832	Moderate-term on-the-job training
Architectural and civil drafters	99,102	9,907	2.1%	3,959	Postsecondary vocational award
Mechanical engineering technicians	38,036	3,326	1.8%	1,063	Associate's degree
Enviro sci & protection techs, inc health	16,961	3,085	4.1%	1,131	Associate's degree
Industrial engineering technicians	45,232	2,940	1.4%	1,274	Associate's degree
Life, physical & social science techs, all other	28,915	2,444	1.8%	1,652	Associate's degree
Environmental engineering technicians	14,768	2,228	3.3%	690	Associate's degree
Engineering technicians, exc drafters, all other	61,601	2,165	0.7%	1,710	Associate's degree
Electrical and electronic engineering technicians	126,549	1,883	0.3%	3,405	Associate's degree
Drafters, all other	20,613	1,835	1.9%	791	Postsecondary vocational award
Geological and petroleum technicians	9,611	1,719	4.0%	600	Associate's degree
Electrical and electronics drafters	29,721	1,261	0.9%	939	Postsecondary vocational award
Chemical technicians	46,861	1,005	0.4%	1,776	Associate's degree

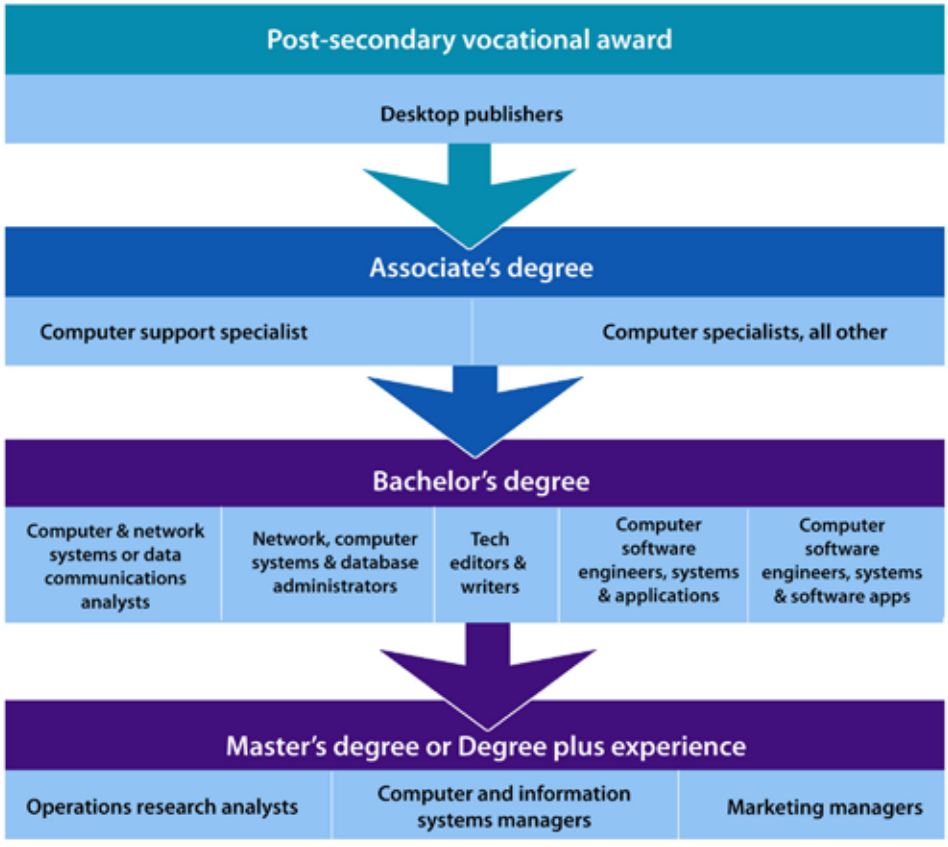
Source: Economic Modeling Specialists, Inc. estimates 2008

Promoting post-secondary educational attainment is a vital consideration in developing an appropriate workforce to fill STEM-related careers available in technology industries. However, there are opportunities at different levels of educational attainment, and often so-called "middle-skills" are a viable entry point for individuals into the careers. As the data above and Figure 5 show, computer support services comprise a large number of jobs in the tech industry's largest STEM-related pathway – information support services; importantly these occupations require only two years of post-secondary education. Furthermore, these jobs potentially lead to many other higher-paying jobs within this career pathway providing the opportunity for continued advancement.

Among the occupations offering the highest pay for entry level workers, computer specialists, engineering technicians, and drafters offer average earnings of $12-$16 per hour. As Figure 6 illustrates, median earnings for these jobs can range from nearly $20 to $33 per hour, reflecting the demand for workers with specialized skills.

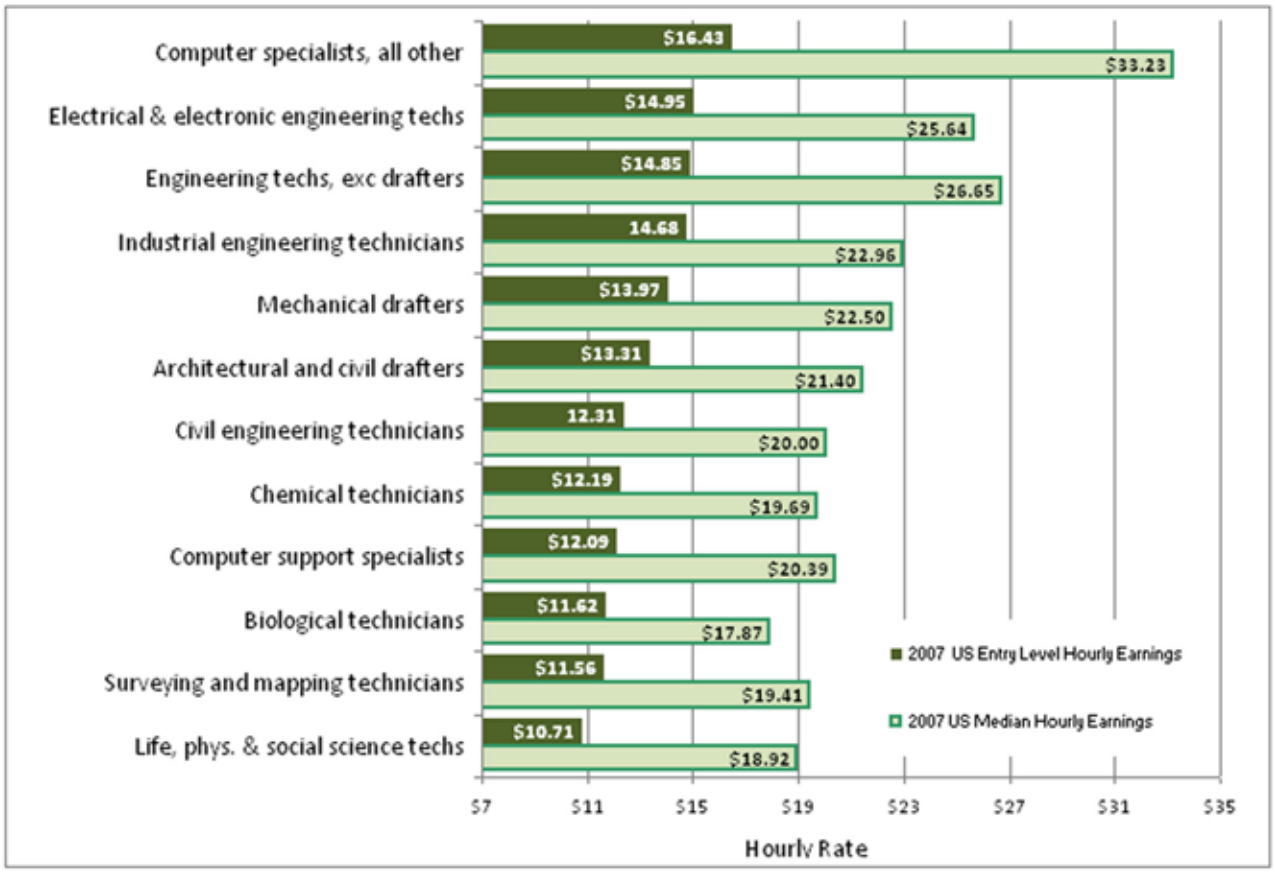
While these occupations often require specialized job-related knowledge, most workers must acquire these skills either through on-the-job training or related post-secondary education programs. To ensure that low-income incumbent workers are able to compete for jobs that are becoming increasingly complex, it is vital that states recognize the needs of this workforce segment as well as their potential importance as a source for meeting the middle-skill workforce requirements of technology companies.

Figure 5: Information Support Services Career Pathway by Level of Education Attainment



Occupations in US Dept. of Education's Information Support Services Career Cluster

Figure 6: Entry Level and Media Hourly Earnings for Selected Large Tech Industry STEM-related Occupations



Source: EMSI, 2007 Earnings Per Hour Estimates

Policy Implications for States

States seeking to succeed in transforming and growing their economies must think about the full range of skills and talent needed to fill all levels of STEM-related occupations. Although state policy-makers are investing to increase education and training levels in STEM disciplines, too often the policies omit training to prepare workers for middle-skilled and technical STEM jobs. To insure a sufficient supply of qualified workers at all existing levels, states must make investments to prepare low-skilled adult workers to gain STEM skills.

To date, the vast majority of state initiatives to promote STEM are aimed at K-12 and traditional college students. These important programs are designed to help young adults find careers in STEM occupations or technology-related industries by focusing on career and technical education (CTE) in high schools and community colleges. Increased investment in CTE is certainly critical to create future pipelines for these technical careers, but alone these initiatives do not address the company workforce demands of today.

State initiatives designed to prepare existing adult workers for STEM occupations and careers are much less common, but properly designed and focused career and technical education can play a critical role in facilitating and supporting TBED. The 2008 State New Economy Index makes this point by measuring the quality of a state's workforce education and noting that education and skills development should not be solely focused on engineers and managers in high-technology industries, but also incumbent workers in manufacturing and "low-tech" services.[10] Rob Atkinson, co-author of the Index and President of the Information Technology and Innovation Foundation, emphasizes that "if states are to be successful in spurring more innovation-based economies they can't just focus on high-level STEM skills, they also have to put in place robust and effective initiatives to

ensure that existing workers have the education and skills to fill middle-skill STEM positions."[11]

A few states are attempting to address the barriers for existing workers to move into middle-skill careers.

In **North Carolina**, the state established a biotechnology training initiative targeted to incumbent workers in the biomanufacturing industry as firms indicate that they prefer experienced workers – whether or not they began in the field. The state engaged its community college system to create a series of occupational courses to help people make the transition into the industry. The courses include training specifically for technicians, using a mobile lab training space designed to bring the classroom to the workplace. The BioNetwork Mobile Laboratory (or the BioNetwork-Bus) offers worker training exclusively at company sites and local community colleges. The BioNetwork Mobile Laboratory accelerates laboratory-based biotechnology training for workers (receiving community college credit) in remote areas by providing access for workers and companies to specialized equipment and experienced faculty. The mobile lab can accommodate eight students at a time and provides the facilities for many lab-intensive short courses. Since January of 2007, the BioNetwork mobile lab has been used to train 234 people, representing 72 percent of the trainees completing the BioNetwork's Capstone Center program during that period.

Another initiative, the **Michigan** Regional Skills Alliance (MiRSA) focuses workforce development efforts on the needs of specific industry clusters. Proposed by the Governor in 2004, the Alliances are employer-driven partnerships that focus on regional occupation-specific training needs. As of July 2008, the state has invested about $3.5 million in 37 MiRSAs working with eight different industries. Health care is the focus of one-third of the alliances. Other industries targeted include advanced manufacturing, forestry and agriculture, tourism, information technology, biotechnology, construction, and utilities. Many of these industries offer opportunities in STEM-related careers. In fact, one alliance is focused exclusively on STEM occupations. South Central Michigan Works! currently sponsors a business STEM survey to determine the employer skill and competency needs in its three-county region. The broader effort is focused on assessing current STEM-related skills of the region's entry to mid-level workforce to determine how well they match business skills needs. This information serves as a baseline for developing curriculum to upgrade worker skills to meet the demands of these employment opportunities.

Pennsylvania created the Industry Partnerships (IP) program modeled on Michigan's Skills Alliance, but has invested significantly more in the program, providing support to 88 different regional initiatives, many of which are focused on technology industries and the STEM skills that they require. Like the Michigan Skill Alliances, each of the partnerships serves specific geographic regions linked to key local industries, such as electronics, advanced manufacturing, robotics, maintenance and logistics, medical device, plastics, and an array of allied health care fields. Each IP seeks to aggregate employer training needs and provide insights to area educational institutions on how to adapt curricula to meet employer needs. In some cases, the Partnerships are also developing cross-company career ladders for workers. The program received substantial state investment – an estimated $20 million per year in state investments (including funding to support Partnership network managers). That funding has attracted foundation and other investments as well.

In **Oregon**, the state has contracted with Worksystems, Inc. – a nonprofit training organization that connects jobseekers to employers – to manage the Employer Workforce Training Funds. Funded initially in 2006 with $6 million, the Oregon Department of Community Colleges and Workforce Development provides much of the training, and Worksystems, Inc. is working closely with a variety of statewide industry networks, including the Software Association of Oregon and the Oregon Biosciences Association, to engage small companies in the program. In implementing these programs, Worksystems, Inc. collaborates with sector groups to analyze labor market information, project sectoral workforce needs, market the industry, access grants, subsidies, or tax credits, as well as develop appropriate workforce solutions. The sectors that Worksystems, Inc. is helping include: the "creative" industries, food processing, construction, high tech manufacturing, tourism, health care, metals manufacturing, professional and business services, and retail. In working with these industries,

Worksystems, Inc. is seeking to focus on high demand occupations, several of which are STEM-related. The initiative provides training, support and access to career pathways that benefit low-income job seekers and low-wage individuals already working in the industry.

These examples, although modest, demonstrate ways to include low-skill workers in STEM-related education and training programs. However, several barriers limit more workers from making the transition to STEM careers.

- State initiatives to assist with adult career transitions are relatively few and resources available are modest in size when compared with broader incumbent and dislocated worker training efforts.
- Information about STEM-related career opportunities is not readily accessible for many incumbent workers.
- Adult workers face many family and financial impediments in making a mid-career change.

Even among the examples cited above, few are actually STEM-specific even though they all recognize the importance of STEM occupations in some of their targeted industries. These efforts focus on making a difference for specific industries in certain sub-state regions, but few of them have achieved scale. Efforts to address the needs of dislocated or incumbent workers have largely been reactive and not highly targeted to tech-based industry needs or STEM-related careers.

Information about job opportunities may be an important influence on existing worker attitudes about STEM-related careers. Workers may be more open to receiving career guidance related to jobs that are "within reach" in terms of education required to make the next step in a specific career pathway. While career information certainly exists, there are seldom opportunities for incumbent workers to access it. In some cases, Workforce Investment Act (WIA) one-stop center counselors may be a resource, but only once a worker loses his or her job and is most financially vulnerable. For many working low-income families, the immediate need to support themselves and their families often limits the amount of time available to prepare for investments in a career change, especially if they do not already have a job. For existing workers exploring STEM careers, it is important to understand that for every specialized occupation requiring a four-year college degree, there are often as many jobs available for technicians and assistants. These jobs do not demand as much education, but they often offer family-sustaining wages and can frequently be a stepping stone toward more advanced opportunities.

Each STEM job is often part of a more extensive set of career opportunities. It is important for states to frame workforce and economic development policies in ways that benefit non-traditional students. This includes demonstrating the potential for immediate as well as long-term payback in STEM-related careers and offering alternative means for gaining the necessary education and skills. This is particularly important for existing workers who are seeking to enhance their skills for more rewarding careers in technology companies or in STEM-related occupations. State policies need to support the development of educational technology ladders that upgrade workers' basic skills through contextualized learning and link those workers to industry-recognized credentialed programs that are foundational for STEM occupations. Finally, all education and skills development programs must be affordable for low-income adult workers.

Targeted, systemic public policies aimed at effectively serving low-skilled workers must address the skills gap encountered by many technology companies. A recent U.S. General Accountability Office study indicated that most STEM support was provided through financial aid to traditional students rather than incumbent workers.[12] The U.S. Department of Labor is placing greater emphasis on STEM disciplines as a fundamental element of successful adult workforce investment programs, and those efforts go well beyond providing tuition reimbursement.[13] If playing their role appropriately, local Workforce Investment Boards and community colleges can provide individuals with linkages to financial aid and appropriate support services. States must also increase and target financial aid to help current workers seeking to upgrade their education and training in STEM-related careers.

Conclusion

Working low-income families can benefit from growth in technology industries because these compa-

nies will be the source of the best jobs for today and the careers for tomorrow. State policymakers must recognize that TBED initiatives, which often involve millions of dollars of state funding, must include policies and programs that give significant attention to middle-skill occupations and related positions. This is not only good policy for low-skilled workers, but as significantly, addresses the needs of business for qualified labor at all levels of work.

The good news is that the American economy continues to create many new jobs in certain high wage industries, even in the toughest of economic times. Most of those good-paying jobs demand that workers achieve increasingly higher levels of education and training. For low-income families with adult workers already in the workplace, skill development is a long-term challenge that faces a variety of personal and work-related hurdles. State initiatives aimed at promoting longer-term STEM education among adult workers offers one of the best opportunities for helping businesses meet their need for middle-skill workers, while also providing family-sustaining pay for those seeking family-supporting employment.

WORKING POOR FAMILIES PROJECT RECOMMENDATIONS:

1) Ensure that state investments in technology-based industries and STEM-occupations consider low- and middle-skill positions.
2) Integrate specific workforce development efforts aimed at preparing middle-skill incumbent workers with state TBED initiatives.
3) Develop explicit career education and training programs to guide workers (and support organizations) in clearly understanding how they can move from dead-end/low-skill jobs to STEM-related careers.
4) Improve educational curricula and delivery methods in STEM fields to enhance the interest and access of adults and non-traditional students.
5) Ensure the availability of appropriate aid and support services to help adult workers finish high school, access relevant post-secondary opportunities, and transition to more stable STEM related careers.

Endnotes

[1] The author is CEO of the Center for Regional Economic Competiveness. Special thanks to David Altstadt, Robert Atkinson, Marianne Bellesorte, Roberta Garber, Deborah Povich, John Quinterno, Brandon Roberts, Peter Ruark, Andrew Reamer, and Gary Yakimov, all of whom provided important input on this policy brief.
[2] Tom Waldron, Brandon Roberts and Andrew Reamer. "Working Hard, Falling Short," Working Poor Families Project, October 2004, p. ii.
[3] Atkinson, R. and Wial, H. "Boosting Productivity, Innovation, and Growth Through a National Innovation Foundation," Brookings Metropolitan Policy Program, April 2008, p. 4.
[4] A definition and examples of STEM-related occupations can be found in the paper by Nicholas Terrell, "STEM Occupations: *Occupational Outlook Quarterly*, US Bureau of Labor Statistics, Spring 2007, pp. 26-33.
[5] Harry J. Holzer and Robert I. Lerman, "Forgotten Middle-Skill Jobs: Education and Training Requirements in the Next Decade and Beyond," Workforce Alliance, November 2007.
[6] Source: Analysis of US Bureau of Labor Statistics, *Occupational Employment Statistics*, May 2007.
[7] Adapted from a description of "What is Technology-based Economic Development as provided by the State Science & Technology Institute on its website: http://www.ssti.org.
[8] Dan Berglund, joint presentation with Ken Poole, "TBED Trends and Implications for the Manufacturing Extension Partnership," State Science and Technology Institute, NIST MEP National Conference, presentation, April 28, 2008.
[9] Daniel E. Hecker, "High-technology employment: a NAICS-based update," *Monthly Labor Review*, US Bureau of Labor Statistics, July 2005, pp. 57-72. According to Hecker, about 4.9 percent of the average industry's labor force is employed as a scientist, engineer, or technician. Industries with at least twice that concentration are said to be "high technology." Hecker identifies those industries by previously standardized North American Industrial Classification System (NAICS) codes.
[10] Robert D. Atkinson and Scott Andes, *The 2008 State New Economy Index: Benchmarking Economic Transformation in the States*, The Information Technology and Innovation Foundation, Washington, D.C. November 2008.
[11] Robert D. Atkinson, November 21, 2008.
[12] U.S. Government Accountability Office, "*Testimony before the Committee on Education and the Workforce, House of Representatives, Higher Education: Science, Technology, Engineering, and Mathematics Trends and the Role of Federal Programs*," May 3, 2006, p. 16.
[13] Jobs for the Future, "*The STEM Workforce Challenge: The Role of the Public Workforce System in a National Solution for a Competitive Science, Technology, Engineering, and Mathematics (STEM) Workforce*," April 2007.

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