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A Sharper Focus On Technical Workers

How to Educate and Train for the Global Economy

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A Sharper Focus On Technical Workers

How to Educate and Train for the Global Economy

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This report presents a case study of the Automotive Manufacturing Technical Education Collaborative (AMTEC), which brings together auto manufacturers and community colleges across 12 states to identify and implement wide-ranging improvements in technical education for automotive manufacturing workers.

The case study was launched during a roundtable on community college–industry partnerships that was organized by the NGA Center and supported by a grant from the National Institute of Standards and Technology (NIST). The case study was further developed through an extensive site visit and benefitted from interviews with the following individuals:

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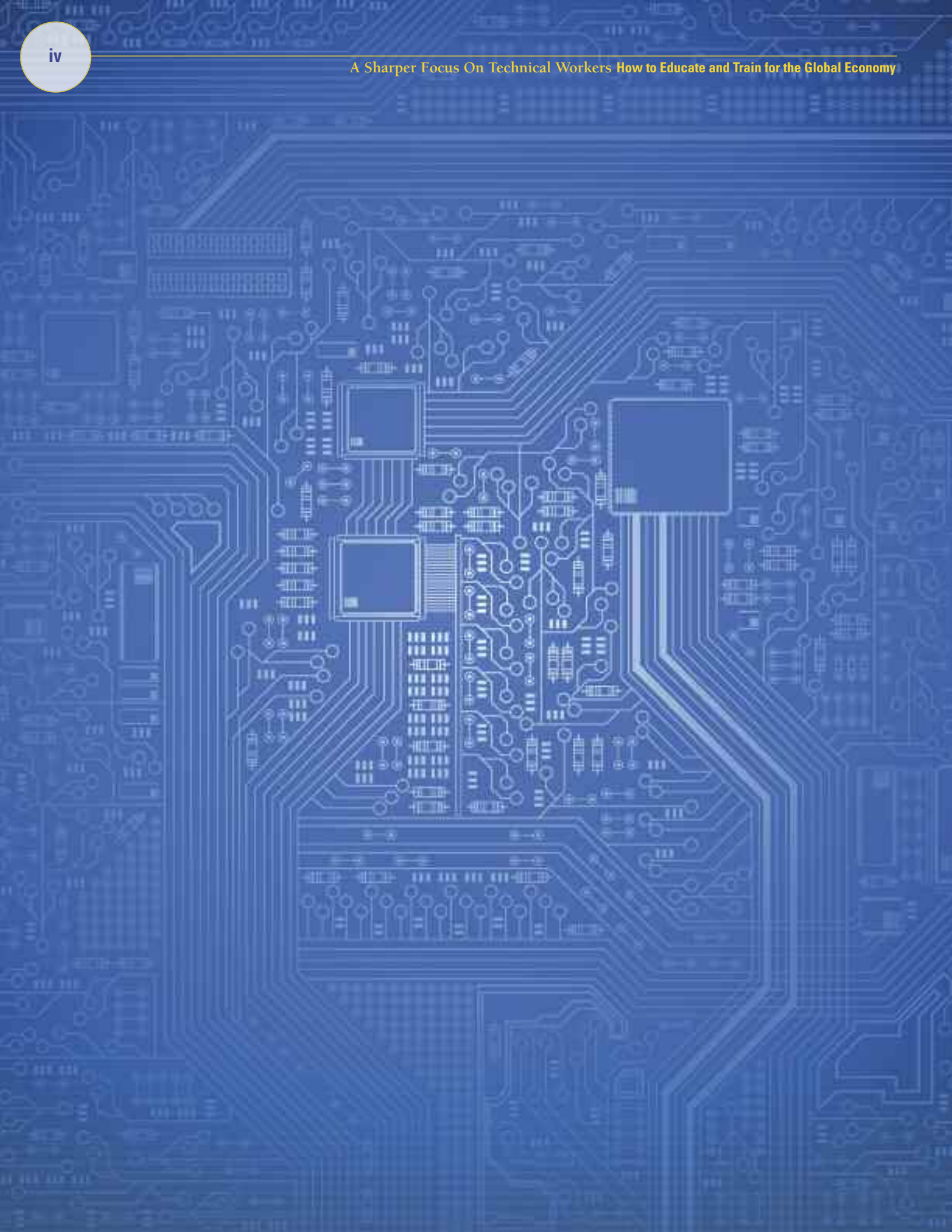


EXECUTIVE SUMMARY

America needs great skilled workers—and lots of them.

The Automotive Manufacturing Technical Education Collaborative (AMTEC) story shows that it is possible for governors to work collaboratively with industry, with community colleges, and with each other to provide people with the opportunity to build their technical skills and ensure both America's future prosperity and their own economic security..

A "Big Collaboration"—AMTEC involves 30 community colleges and 34 auto-related plants in 12 states—could be what America needs now to train and retrain workers for jobs in new and fast-growing industries, including positions in the health care and green energy sectors, among others. Creating one or 10 innovative training programs at a time will not provide the capacity to make a difference on a national scale. To start to build effective worker training programs—in clean energy, for instance—governors can use this auto manufacturing case study, build on it, and deploy transformative collaboration to prepare individuals for these important and growing industries.

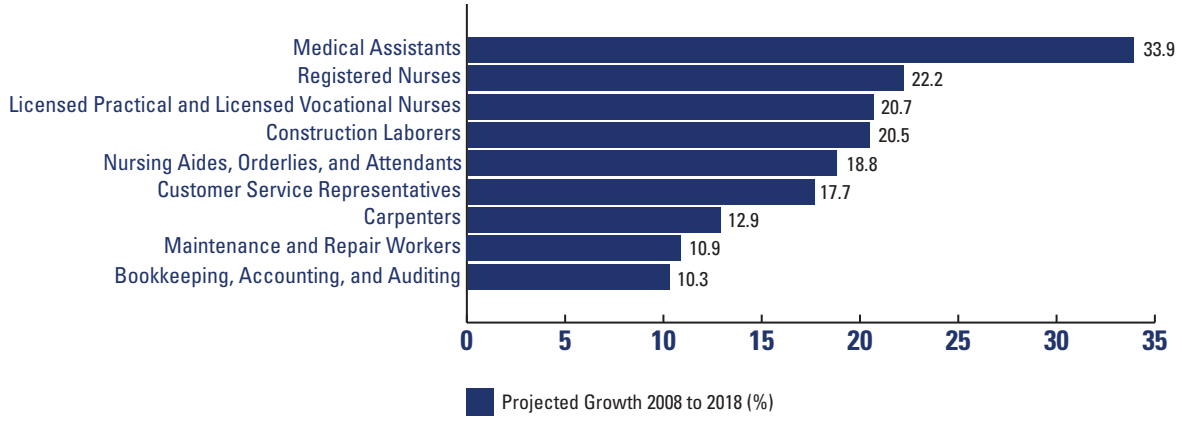
In addition to getting ideas for a very different kind of partnership, governors can find in the AMTEC case study the following important lessons about the future of technical workers and their education:

- The United States must value and invest in technical education in manufacturing and other sectors, as other nations do.
- Technical education must reflect the requirements of the knowledge economy—skills such as critical thinking and problem solving—because these attributes are important in today's manufacturing and other technical work settings.
- Real-world curricula must be developed collaboratively with the relevant industries so that the skills being taught are precisely those that the industry needs.
- Technical education must be rigorous and continuously improved so that students are able to step into technical jobs and translate their learning to the workplace easily and quickly.

The bottom line is that the AMTEC case study points to a future in which companies, colleges, and students get what they need to prosper. Governors can shape a new future for job training in a way that will nurture and grow the largest, most important, and—in many cases—fastest-growing industries by taking the following actions:

- **Champion the importance of technical education and technical work to economic competitiveness and worker prosperity.** Between 40 percent and 45 percent of all job openings in the economy through 2014 will be in middle-skilled occupations that require postsecondary education and training but not necessarily a bachelor's degree.[1] High-quality technical education, especially from community colleges, is likely to be the bread and butter of key sectors of our economy in the future: manufacturing, energy, health care, and others.
- **Focus first on the industrial sectors with the greatest economic impact.** The most valuable credentials are those in quantitatively oriented fields or high-growth/high-need occupations.[2] Governors can use the economic analysis and development resources at their disposal to identify the industrial sectors with the greatest potential and most in need of transformative collaboration with community colleges and industries.
- **Use state spending to encourage community colleges to engage in collaboration and innovation.** Community colleges rely on states and localities for the lion's share (nearly 60 percent nationally) of their revenues.[3] Governors can begin to use their support of community colleges to reward institutions that meet state economic goals. Similarly, governors can pursue federal funding for workforce development and community colleges strategically and collaboratively.
- **Develop multi-state partnerships focused on providing consistent, high-quality, industry-valued training.** Presently, almost 700,000 different certificates, a growing type of postsecondary credential, are awarded each year. However, certificates and other credentials often have little or no value because they are not held to nationally or internationally accepted standards and are consequently not recognized by employers or education institutions.[4] When states have similar technical education needs, they can help each other "scale up" more easily in a wide range of industries. States can also cut costs by working together and being more responsive to individual companies and entire industries that cross state lines.
- **Require comprehensive outcome data to assess students' skills and credentials gained, hold educational institutions accountable, and inform policymakers.** There is widespread consensus that improved information on student outcomes is needed if the nation is to meet its ambitious educational attainment goals.[5] The AMTEC model has standardized a common set of metrics for assessing student performance and outcomes that can be a building block for a comprehensive accountability system that shows whether higher education institutions are meeting employers' and students' needs in terms of knowledge and skills acquired and credentials attained.

Technical Jobs with Largest Employment Growth



Of the 30 occupations projected to have the largest job growth over the next decade, 19 require less than a four-year degree. Nine of the 30 require an associate's degree, postsecondary vocational award, or long- or moderate-term on-the-job training—the level of training that would benefit from a new kind of technical education.

Source: "The 30 Occupations with the Largest Employment Growth, 2008-18." U.S. Bureau of Labor Statistics, Employment Program, Employment Projections 2008-2018, December 11, 2009.

Introduction

America needs large numbers of highly skilled workers. The Automotive Manufacturing Technical Education Collaborative (AMTEC) story shows that it is possible for governors to work collaboratively with industry, community colleges, and each other to provide people with the opportunity to build their technical skills and ensure both America's future prosperity and their own economic security.

America's economy depends on workers who are knowledgeable and agile and who know how to troubleshoot and problem solve in real time in real-world situations, whether in factories, in hospitals, in labs, or in any other workplace setting. This is especially true now because American workers and entire industry sectors are struggling to compete on a global playing field.

Manufacturing is a good example. America still needs millions of manufacturing workers. Despite considerable declines in recent years, more than 10 million Americans still work at manufacturing jobs. One recent study found that 32 percent of manufacturing companies surveyed report moderate to serious shortages in the availability of manufacturing workers and expect the situation to worsen in the next few years.[6] And, as the recent economic trouble with the automobile industry has reminded us, manufacturing—with its well-paying jobs and its extensive supplier chains—has a huge impact on the rest of the economy.

To succeed, manufacturing and technical workers need to be better trained, more creative, and more highly skilled than ever before. Like their counterparts in other settings, such as hospitals and labs, manufacturing workers are now "knowledge workers" who must use their brains every minute of every shift to get the job done. They must understand complicated processes and be able to predict, prevent, troubleshoot, and solve problems in a high-pressure environment. This means that, as in other economic sectors, high-level, multidisciplinary technical training is a vital part of worker preparation.

Yet a growing body of evidence shows that many programs, policies, and investments are failing to educate the new workforce. Too often, the focus is on traditional classroom learning, which prevents students who might thrive in the factory environment and in modern production systems from gaining the right skills to succeed after graduation. Experienced educators in technical training are often behind the curve or spend too much time in the classroom, disconnected from rapidly changing technology and the organization of work on the factory floor.[7]

This problem is not limited to the manufacturing sector. Across a wide range of industries that still rely on what used to be called "blue-collar" workers, institutions are not teaching the skills that employers need. The private sector spends roughly $135 billion per year training its workers, struggling to correct for an ill-prepared workforce.[8]

Higher education sponsored by states—especially community colleges—should serve as the foundation for a new kind of technical training. Community colleges cannot act in isolation, however; at worst, doing so would lead to failed policies and, at best, to successful pilot projects, innovations at individual institutions, and other small-scale improvements that fail to increase the number of skilled workers nationwide.

The modest successes of traditional job training are not enough. What is urgently needed is a way to "scale up"—to apply transformations in technical training broadly, across entire sectors and across the 50 states, so that states can finally make a big dent in fixing the sluggish and often ineffective technical education system. America needs a new kind of technical worker, and states must insist that these new technical workers be trained through large-scale collaborations between industry and education.

Transformative Change: The AMTEC Model

The model for this kind of big, transformative change may come from America's heartland, the base of the American manufacturing sector, especially the automobile industry, which is located along Interstate 75 from Michigan to Georgia. Seeded originally by Toyota's training needs in Kentucky, AMTEC emerged to work collaboratively with auto manufacturers and community colleges in identifying and implementing wide-ranging improvements to technical education for skilled maintenance workers in advanced automotive manufacturing environments.

Although this program began as a partnership between Toyota and the Kentucky Community & Technical College System, the successful achievement of its goal allowed it to expand to include community colleges and auto manufacturers up and down the I-75 and I-65 corridors and beyond into a national model with international reach. Remarkably, it is a collaboration that transcends the most prominent divisions in the industry. AMTEC includes domestic and foreign auto manufacturers, northern and southern states, and union and non-union plants.

This case study is the result of a wide range of interviews with companies and community colleges as well as background research on technical education methods in the United States and other countries. The AMTEC case study highlights the following important lessons about technical education and its role in creating and maintaining prosperity in the America of today:

- The United States must value and invest in technical education in manufacturing and other sectors, as other nations do.
- Technical education must reflect the requirements of the knowledge economy—skills such as critical thinking and problem solving—because these attributes are important in today's manufacturing and other technical work settings.
- Real-world curricula must be developed collaboratively with the relevant industries so that the skills being taught are precisely those that the industry needs.
- Technical education must be rigorous and continuously improved so that students are able to step into technical jobs and translate their learning to the workplace easily and quickly.

But why is this effort transformational and an important model to replicate? It's simultaneously big picture and detail oriented. AMTEC is focused on an audacious goal: making sure that there is a new generation of skilled and well-trained maintenance workers who can compete with workers in the rest of the world. But the AMTEC approach moves toward that goal by identifying technical education needs very precisely and breaking those needs down into component parts (modules) that can be learned flexibly and coherently so that the system yields educated, highly skilled auto workers who can function quickly and independently in the fast-paced environment of the modern factory. (See figure below.)

AMTEC's Audacious Goal

Source: Annette Parker, System Director, Kentucky Center of Excellence in Automotive Manufacturing & AMTEC Principal Investigator.

This study offers governors guidance on how to approach technical education and use it as a basis for workforce development from the perspective of employers and workers, thereby ensuring prosperity. There's a vital lesson here for governors: you can increase your economic competitiveness across the board—even in struggling businesses and industries—if you follow the AMTEC model of close and specific collaboration between companies and higher education, particularly community colleges. This can lead to education and training that reflects the requirements of the global economy. This is especially true in advanced manufacturing—the high-wage, high-skill manufacturing most common in the United States—but it's also true in the life sciences, the green economy, and other fast-growing parts of the American economy.

Toyota Comes to America—and Challenges the Country's Technical Education and Job Training System

One example of AMTEC's collaborative approach to working with companies comes from Bluegrass Community & Technical College and its collaboration with Toyota Motor Manufacturing Kentucky. Toyota's manufacturing plant in Georgetown, Kentucky, is located off of I-75 just north of Lexington—a straight five-hour drive south from Detroit along the highway known since the 1980s as America's "Auto Alley." It's a huge plant—more than 7 million square feet (about the same size as 121 football fields). The Georgetown complex is actually two assembly plants—one built in the 1980s and a second built in the 1990s—and includes outsized shops for tool-and-die operations, plastics, and other functions that serve all of Toyota's North American plants.

All of the innovative Toyota Production System elements are present at the Georgetown plant, including assembly crews that work in groups of four and a line-stopping cord, called an andon, that anyone who sees a problem can pull. With overtime, skilled maintenance team members can earn between $70,000 and $80,000 per year.

There are only two job classifications at the plant: one for production and one for maintenance. Maintenance includes general maintenance and tool-and-die workers. Within maintenance, workers are expected to be multi-skilled—a critically important point for the AMTEC story.

At the north end of the massive Toyota site sits the regional training and development center known as Toyota's North American Production Support Center—one of the original buildings from the 1980s on the Toyota site, but recently renovated to be a LEED Silver–certified green building. Upstairs in the training complex is a special campus of Bluegrass Community & Technical College, known as the Georgetown Manufacturing Center.

Walk through the second-floor door, however, and you don't see a classroom. You don't see desks or chairs or a blackboard or a lectern. What you see is a small-scale replica of the factory next door. Bluegrass instructors collapse the barrier between conceptual knowledge and hands-on application by integrating instruction so that students apply what they learn immediately. Rather than spending an excessive amount of time in a classroom, disconnected from the manufacturing floor, they are constantly making the connections between concepts and skilled work. Current Toyota workers, along with traditional students and workers employed by local manufacturers, can attend class before or after their shift to participate in the training. E-learning, hands-on time in a lab, and problem-solving exercises are also provided.

Toyota originally partnered with the local community colleges because the company needed a type of technical training that other colleges did not offer. Unlike traditional auto manufacturers, which had dozens of job classifications for workers with specialized skills, Toyota emphasized multiple skills, especially for its maintenance technicians. Toyota maintenance workers do not specialize; rather, they are able to fix any maintenance problem anywhere on the assembly line or in the shop at any time. (Other auto companies are now adopting this model.)

Toyota's challenge to its partner, the Kentucky Community & Technical College System, was to create a curriculum that would train workers for their multi-skilled maintenance jobs according to company specifications. This approach worked well and established the foundation for the multi-state, multi-college, multi-company consortium known as AMTEC.

AMTEC reflects the future because the future involves a very different kind of technical worker, a very different kind of partnership, and a very different kind of education.

The Future Involves:

A Very Different Kind of Technical Worker

The 21st century is the era of knowledge workers—people who use their knowledge and creativity constantly on the job to increase both their own productivity and the value of the products they are helping create. Technical workers of all kinds—and especially manufacturing production and maintenance workers—are usually overlooked in this definition on the theory that they aren't really using their brains or their creativity and that they aren't really contributing to the value of the products they make.

But the stereotype of the technical worker as all brawn and no brains is 20th-century thinking. In the 21st century, every job is a knowledge job, and every worker is a knowledge worker. Every technical workplace—from the hospital to the factory—is a fast-paced environment in which mid-level employees must know how to function as individuals and as a team amid rapid technological changes, how to assess information, and how to diagnose problems quickly, using problem-solving and critical-thinking skills to make split-second judgments. The ability to make those judgments correctly can save lives in some settings and increase both productivity and quality control in every situation. It is a cornerstone of a sustainable, high-value economy such as America's.

Furthermore, today's productive and creative workers must be both highly skilled and multi-skilled. A century ago, productivity and efficiency gains in factories depended in large part on breaking work down into standardized pieces—in essence, turning the workers into robots. Today, however, actual robots do most of the routine work, so the old paradigm has been turned upside down. Technical workers today must be the opposite of robots—flexible, creative, versatile people who make sure that the routine work hums along on its own. (See the sidebar, "A Business Practice of Continuous Improvement Demands a New Kind of Technical Worker.")

Technical workers must be able to identify problems and bottlenecks as well as come up with solutions. A simple example: A group leader over the door line in a Toyota plant noticed that damages to side mirrors on the front doors of the Camry were leading to increased scrap, which was a cost issue for her team. Her first solution was to set up a temporary repair area where her team members could use the salvageable parts from damaged mirrors to make good mirrors. Her next step was to identify the cause of the damages. Most seemed to come from an air tool that team members used to shoot screws into the mirrors. Together, she and the team developed a better method for using the same tool that caused less damage to the side mirrors. Finally, she met with product development engineers to design a mirror that was attached with a hex-head bolt instead of a small screw. This solution led to a reduction of scrap and production time and illustrates the level of critical thinking needed on the production line to keep companies competitive.[9]

Today's technical worker is a very different kind of worker than in generations past: a knowledge worker who must use his or her brain all the time but in a highly applied manner to keep technical work on track. Traditional technical education and training simply don't provide such workers with the skills they need to succeed—or the skills their employers need to be competitive.

A Business Practice of Continuous Improvement Demands a New Kind of Technical Worker

Toyota is known for its philosophy of continuous improvement—improving all processes every day—yet, the business practice of encouraging work routines that lead to advancements in every activity and at every level of the company has now spread throughout the world of auto manufacturing. To compete, all local manufacturing plants need a workforce that participates in problem solving and productivity, quality, and safety improvement. The practice of continuous improvement demands bottom-up creativity and innovation. This, in turn, means training workers to:

- **Develop a solution that works for a particular situation at a particular point in time**
- **Adapt the solution when the situation changes**
- **Experiment**
- **Think outside the box and come up with unconventional solutions to problems**

The Future Involves:

A Very Different Kind of Partnership

The idea of an auto manufacturer working collaboratively with a community college isn't new. In Michigan, the Big Three auto companies have been working with community colleges for decades. What is new *is* collaboration by 30 community colleges and 34 auto-related plants in 12 states to identify a common set of technical skills required in their plants and a common curriculum and method of teaching to ensure that skilled maintenance workers in the auto industry have those skills.

AMTEC emerged from the company–college collaboration that began in Kentucky between Toyota and the Kentucky Community & Technical College System's Center for Excellence in Auto Manufacturing. But AMTEC is no longer just a Toyota–Kentucky effort. This idea of developing technical talent by creating a very specific and detailed curriculum that corresponds exactly with the skills required for today's manufacturing production process is being implemented in Kentucky, Michigan, the states along Auto Alley, and throughout the nation through a multi-state collaboration. The specific and detailed approach—teaching to industry standards—is what allows the AMTEC approach to be "scaled up" from a pilot program benefiting only one state to one that can transcend state boundaries and benefit 12 states (see map of AMTEC partners).

During a conference in 2004, community and technical college leaders from Michigan, Ohio, Tennessee, and Kentucky were discussing their various automotive manufacturing training programs and services. An idea was planted to develop a cooperative effort across college boundaries, state lines, and competing company interests to share best practices and resources.

From its first planning meeting in 2005, AMTEC was a very different kind of partnership. For one thing, it really was a partnership. Educational institutions, auto manufacturers, and suppliers were all welcome—but they could not come alone. They had to come with a partner, so that educational institutions and companies from the same geographical area would be committed to working together even before they showed up. Toyota, General Motors, Ford, BMW, and several large suppliers were there from the beginning, as were community colleges from several states.

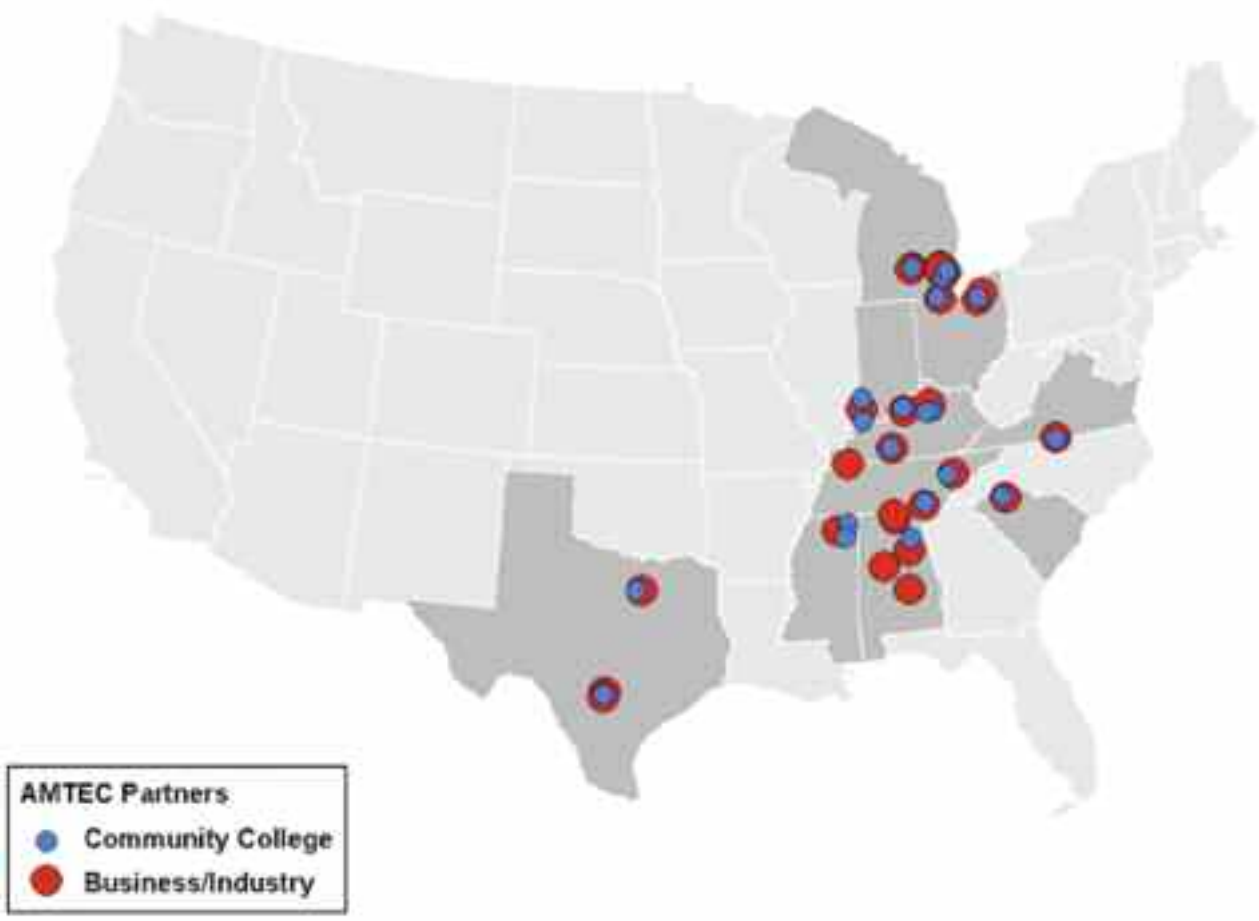
From the beginning, the AMTEC partners had one goal in mind: to produce the multi-skilled workers needed by the American auto manufacturing industry. To accomplish this goal, AMTEC had to embrace the following key principles:

- Keeping American manufacturing competitive not just by cutting costs but by nurturing top talent and focusing that talent on the skills required for advanced manufacturing.
- Training technicians to be multidisciplinary problem-solvers, to think in systems, and to be an integral part of continuous improvement, not simply human robots on the assembly line.
- Bringing renewed dignity and respect to technical education and manufacturing work.

Perhaps most impressively, AMTEC is an entirely bottom-up effort that has succeeded in scaling up from one program in Kentucky to a multi-state, multi-company, and eventually multi-national effort. Although AMTEC has received several major National Science Foundation (NSF) Advanced Technical Education grants—the most recent and largest creating a national center of excellence—it was not established as a top-down federal program. It was created because companies and educational institutions decided to take the initiative on their own to create an industry-wide, multi-state effort to prime the pipeline and provide up-to-date training for skilled maintenance workers—more precisely, equipment maintenance workers in the factory and auto service technicians, or those who work on automobiles after they are sold to customers.

AMTEC Partners Across State Boundaries

Alamo Community College District • Avanzar Interior Technologies • Bluegrass Community & Technical College • BMW • Bowling Green Community and Technical College • Capital Area Manufacturing Council • Chattanooga State Technical Community College • Cuyahoga Community College • Danville Community College • Denso Technical Training Center • Ford Cleveland Engine # 1• Ford Kentucky Truck Plant Ford Motor Co. • Gadsen State Community College CARCAM • General Motors • General Motors Assembly Plant • General Motors Technical Center • GM Arlington Assembly Plant • GM Delta Township Plant & Grand River Assembly • Goodyear Tire & Rubber • Henry Ford Community College • Honda Manufacturing of Alabama • Hyundai Motor Manufacturing • International Diesel-Alabama • Itawamba Community College • Ivy Tech Southwest • Jefferson Community and Technical College • Kentucky Community & Technical College System • Lansing Community College • Lincoln Electric Company • Macomb Community College • Mercedes-Benz U.S. International • Northeast Mississippi Community College • Owens Community College • Pellissippi State Technical Community College • Pontiac Assembly Center • Rieter Automotive North America Inc. • Spartanburg Community College • Tarrant County College • Toyota Motor Engineering & Manufacturing • Toyota Motor Manufacturing Alabama • Toyota Motor Manufacturing Indiana • Toyota Motor Manufacturing Kentucky • Toyota Motor Manufacturing Mississippi • Toyota Motor Manufacturing Texas • Vincennes University • Volkswagen • Webasto Roof Systems Inc. • Woodbridge Lansing



Source: Annette Parker, System Director, Kentucky Center of Excellence in Automotive Manufacturing & AMTEC Principal Investigator.

The Future Involves:

A Very Different Kind of Education

Even as technical jobs have become more important to the American economy, technical education is too often relegated to second-class status. The focus of most higher education efforts has been on four-year college and university education, which often consists of traditional classroom studies that have little relevance to the real world. Many students struggle with this educational model, and most employers simply do not get workers who have the skills they need. But one of the most basic measurements of both an individual's and a community's well being in the United States is "educational attainment"—the percentage of the population holding four-year degrees. This measurement misses the point about most technical work. It undermines both the dignity and the importance of technical education and technical work, which—with appropriate credentials, including associate's degrees and certificates—can provide sustainable, high-wage family incomes.

Meanwhile, the technical education that does exist at both the high school and community college level is not always as relevant or up to date as it should be.[10] Technical education often takes place in a classroom environment. Instructors are often teaching material (or utilizing equipment) that is outdated or somewhat irrelevant. Technical education often misses the most important point of modern technical work: It requires excellent critical thinking and problem-solving skills in a pressure-packed environment on the factory floor, the hospital wing, or wherever the work takes places. It requires people who are smart, well trained and educated, highly skilled, and extremely motivated.

The AMTEC approach to technical education focuses on several key principles that are transferable to other types of technical work:

- A real-world curriculum is developed collaboratively with the relevant industry so that the skills being taught are precisely those that the industry needs—international occupational standards that are common to that industry worldwide.
- Education occurs in a contextual setting—that is, in a work-like environment rather than a traditional classroom.
- Content knowledge and critical thinking are taught together so that students learn problem-solving skills not as part of some separate academic program but at the same time they learn technical skills.
- The curriculum is broken down into the smallest possible components—modules—to ensure that the actual skills an industry requires are taught and that students master each required competency.
- Learning occurs on the most flexible schedule possible: a module at a time, with options to learn modules online when appropriate, and taking modules out of sequences if needed.
- Ongoing assessment and certification processes focus on making sure that workers, companies, and educational institutions are all engaged in a continuous learning process so that the skills and the curricula stay current at all times.

The major key to success in this new type of technical education is the way that industry and education collaborate to create a detailed and specific curriculum that can be broken down into component parts and taught as flexible modules.

Although parts of the curriculum-development approach used by AMTEC have been used in other areas of technical education, AMTEC provides an excellent model for how a comprehensive approach can be used for an entire economic sector, across many geographical areas and involving many companies, including those that compete with each other in the marketplace.

Curriculum Underpins the Different Kind of Worker, Partnership, and Education

Curriculum development is at the core of any educational program, but AMTEC has developed a common curriculum for auto manufacturing using a method known as Developing A CurriculUM (DACUM), which has been enhanced (referred to as Turbo-DACUM) to provide a systematic, methodical, extremely detailed process focused on the actual work done for the specific job.

AMTEC's main focus is to develop a curriculum for multi-skilled maintenance workers in the modern manufacturing production process. The curriculum was developed using the following steps:

1. **Use the knowledge of the actual workers—the subject matter experts.** The AMTEC curriculum development effort began by gathering workers—not supervisors—and asking them a series of detailed questions about what tasks they undertake each day. (See the sidebar, "Question to Workers: 'What Skills Does This Task Require?'")

2. **Break the tasks down into as many small components as possible.** A general description of the task isn't good enough. For example, one set of maintenance tasks identified during curriculum development was predicting and preventing problems, troubleshooting, and repairing and replacing brakes and clutches. But this is too general to design the learning. So AMTEC broke this skill into its more detailed component parts, such as inspecting the brakes for wear and disassembling the disks and pads. This is the level at which curriculum modules must be created.

3. **Identify the specific skills required to perform each task.** A maintenance task requires a specific combination of skills. Once the tasks and their component parts have been identified, AMTEC then worked with employees to determine skills in a number of areas.

   There is a considerable overlap of skills associated with different tasks. But the important point is to identify the tasks and their component parts, and then identify very specifically the skills required to perform each task.

Question to Workers: "What Skills Does This Task Require?"

To determine the skills necessary for each task, workers were asked to define skills in five categories:

Tools and Equipment: What types of tools and equipment are needed to perform this task, and what skills do maintenance workers need to operate the tools and equipment?

Calculations: What calculations are required to perform this task, and what math skills are required to perform these calculations?

Communications: How much does the maintenance worker communicate with others to perform this task, and what communication skills are required to do so?

Technology: What technology is needed to perform this task, and what technological skills must the worker have to do so?

Safety: What safety practices are associated with performing this task, and what knowledge of safety practices must the maintenance workers have to successfully accomplish this task?

When AMTEC was done creating this set of tasks and skills, 26 different "duty areas" and more than 170 different tasks had been identified, all of which require a specific combination of skills. In contrast, previous curricula had identified only about five required basic skills.

4. **Identify the significance of each duty area and each task in each plant.** Different plants operate in different ways, especially in different states and at different companies. So it is important for each partner community college to understand how the skill sets are used in each plant. After all the duty areas and tasks were identified, AMTEC asked the company partners to rank the significance of each one in their particular plant. Such knowledge gives the local college a tremendous amount of information about how the local plant operates and how to emphasize or de-emphasize the different skill sets in their region.

5. **Compare the skill sets needed to the skill sets being taught.** An important part of the curriculum-development process is to bring in the actual instructors to examine the list of skills required and identify which skills are being taught and which are not. This "gap analysis" helps both the company and the college determine where the curriculum gaps are and how to fill them.

Applying the Curriculum Development Method Across Many Companies and Many Situations

The AMTEC partners encompass a wide variety of companies. Some are in the north and some in the south; some are unionized plants and some are not; and many of the AMTEC partners—such as Toyota, General Motors, and Ford—compete with each other for automobile sales. For a successful scale up, the curriculum-development method described above had to follow two important rules:

1. **The curriculum must include only those tasks and skills common to all industry partners.** No individual company wants to undermine its competitive advantage in the process of creating a common curriculum. Therefore, AMTEC's focus is on the fundamental or core skills for maintenance work that are common to all industry partners participating in the program. If a task or skill is required by some companies or plants and not others, then it is not part of the common curriculum.

2. **The curriculum must focus on tasks and skills required, not on how those tasks or skills are organized in any individual workplace.** Work rules vary from company to company and plant to plant; in particular, work rules vary between unionized and non-unionized plants. Some companies may have only one job classification for a maintenance worker; others have many. Therefore, the curriculum must focus only on the tasks and skills required to be an automotive manufacturing maintenance worker; it cannot focus on how those tasks and skills are organized in any particular company or plant.

DACUM Curriculum Revives Ford Motor Company Engine Plant #1

When the Ford Motor Company Engine Plant #1 in Brookpark, Ohio, was temporarily closed in 2000, local plant management and United Auto Worker (UAW) leadership knew that re-opening the plant would depend not only on capital investments and new products but also on their ability to create a work environment in which the workforce participated in problem solving, productivity improvement, quality improvement, and safety improvement.

Ford Motor Company Engine Plant #1 started engine production in 1951. Because of technological changes, two of the engines it produces were decommissioned, and the plant temporarily closed in 2000. Following the decommissioning, Ford made a significant investment in facility renovations and new equipment for the introduction of a new product, the six-cylinder EcoBoost engine. Ford also knew that it would need to invest in the workforce.

In 2008, Ford and UAW leadership invited Cuyahoga Community College to participate as a training partner. The role of Cuyahoga Community College was to modify existing Ford training programs, develop new programs, and deliver the training at the plant during employees' usual work hours.

As a member of AMTEC, Cuyahoga Community College used the results of an AMTEC DACUM to ensure that the training modules that were being provided included industry-identified best practices.

In 2009, Ford Motor Company Engine Plant #1 began production of the EcoBoost engine. Since the resumption of production, most of the 280 employees at Engine Plant # 1 have received some form of training.

These two aspects of the AMTEC program make scaling up far easier. Indeed, this type of curriculum-development approach can be used on a worldwide scale to create a global standard for automotive manufacturing maintenance technicians—especially because manufacturers from four countries are already participating in AMTEC.

Implementing the Curriculum

The curriculum-development method provided AMTEC with a specific roadmap for which skills needed to be taught. However, implementing this curriculum also requires an innovative approach that focuses not on a traditional educational structure but rather on the needs of both the students and the companies.

In the case of AMTEC, the college and its industry partners use the academic structure of an associate's degree. They broke the core standards down into 12 courses, but—as explained later—these courses were broken down even further into small modules. The academic curriculum structure serves as a model that the colleges could adopt as they provide training for their local industry partners. AMTEC is currently in the process of adapting, reusing, and modifying existing materials from all of the college and industry partners to provide the AMTEC industry-endorsed curriculum to the college partners for education and training. An important emphasis is to use valuable resources and not reinvent what they already have but build on the existing resources to have the model curriculum content.

The following critical components are included in this innovative approach:

Small learning modules: Once technical tasks are broken into small component parts, teaching of those components can be broken into small learning modules. The modular approach creates a wide range of benefits:

- Students get a sense of accomplishment by completing modules quickly.
- It is easier for the college to offer a class, because many different students on many different tracks may need the same small module.
- Modules help facilitate the greater flexibility.

Contextual learning environment: The last place that technical education should occur is in the traditional classroom. As the Bluegrass Community & Technical College facility at Toyota suggests, high-quality technical education must occur in a setting that is as close to the actual work environment as possible (see photo). This is a big change not only for students but also for instructors. But it ensures that students are industry ready when they complete their education.

The Georgetown Manufacturing Center—Bluegrass Community & Technical College's Contextual Learning Environment

Flexibility: Students engaged in technical education will be more successful if they have great flexibility in their learning options. Many are already working, sometimes in factories. Others have to work their education around other scheduling constraints. Some students will move quickly through a curriculum, while others will need to move more slowly. For these reasons, a flexible learning schedule is of paramount importance. In particular, the modular approach allows greater flexibility in the following ways:

- Small learning modules permit college to offer classes at many different times.
- In many cases, students can take a learning module online and schedule their hands-on lab separately, greatly increasing their flexibility. An online module can also be continuously updated.
- Students can take modules out of sequence, if necessary, or can "test out" if they can demonstrate that they have already mastered the required competencies, thus reducing the amount of time they spend in school.

Not only do these approaches provide students with more flexible opportunities, they also help to accelerate the learning cycle so that students, if they choose, can move quickly through the curriculum and into productive shop-floor jobs.

Clear standards for assessments and credentialing: Assessing and documenting worker competencies and providing tangible certification such as credentials constitute an important part of the AMTEC model. These tools help to both upgrade and

standardize technical education. AMTEC has worked with industry experts to create the assessment test questions and administered the assessments to long-time technical workers to help identify gaps that these current workers may have in their knowledge and skills.

Getting Results

The assessment process creates advantages for workers, employers, and educational institutions alike. For students and incumbent workers, the assessment can lead to certification, help with both job placement and career mobility, and provide a method of documenting competencies regardless of where or when they were learned. Up-front assessments may also help them get credit for prior learning—an important step, because neither students nor employers can afford the time or money required to re-learn skills already mastered.

Consider Henry Ford Community College in Dearborn, Michigan. Following a gap analysis and AMTEC curriculum implementation, a number of workers have received either college credit or a certificate of completion or competency. Between January 2009 and February 2010, Henry Ford Community College has:

- Introduced 49 high school students to technical skills and careers in a program co-facilitated by high school and college instructors.
- Taught 1,464 entry-level hires from regional manufacturing employers how to think of manufacturing as an integrated system and how to progress along a career path within that system.
- Trained 886 skilled trade employees from regional suppliers in ongoing maintenance skills.
- Enrolled 69 students in associate's degree programs as registered apprentices.

For employers, certifications and assessments assist in hiring, promotion, and planning for internal training.

For educational institutions, certification and assessments provide a method for benchmarking the quality of skills and knowledge that their curriculum provides against the occupational standards actually required in an occupation.

Summary: Why the AMTEC Approach Works and How It Can Be a Model for Other Sectors and for Scaling Up

Now that AMTEC has identified a very specific curriculum for automotive manufacturing and maintenance workers, this curriculum is being implemented up and down the I-65 "Auto Alley" corridor by community colleges in 12 states working with different auto manufacturers and suppliers. It's just as relevant in Michigan as it is in Kentucky.

There are lessons states can take from this collaboration across corporate, educational, state, and national boundaries. First, it is successfully scaling up a local approach. The entire country is suffering from pilot fatigue, a term that conveys the feeling that so many state and federal initiatives are focused on pilot projects, innovations at individual institutions, and other small-scale improvements that, while important, have not led to large-scale transformations of workforce training systems. The AMTEC example effectively shows how state policymakers and business leaders can address not only a need for smarter and different policy responses but also address the need for large-scale reform and results.

Second, the process can be transferred to other sectors where training and education of technical workers is a challenge, such as the health care and energy fields. The AMTEC approach meets industry's need to provide education anytime, anywhere, in any form that gets the job done, and meets both employer and student needs. It helps to standardize the common metrics—local, regional, national, and international—for assessing student performance and student outcomes in technical education.

A 2008 survey found that participation in AMTEC led to following accomplishments:

- **50%** of industry participants introducing changes in the training and education of their maintenance workers
- **85%** of the surveyed community college participants becoming more active in curriculum development
- **50%** of community college participants revising courses
- **56%** percent of the community college participants introducing a new course to deal with the needs of the local auto industry
- **55%** percent of the community college participants educating more students in the automotive industry[11]

By working intensively together, industries and community colleges shift the educational model from one driven by academic expectations to one driven by industrial and business needs. (See the sidebar, "A Shift to Collaborative, Industry-driven Job Training.") Such a partnership requires the intensive collaboration of both industry and education all along the line, and it requires using community colleges as a distribution network for knowledge and learning on what manufacturers would refer to as a *just-in-time model.*

The bottom line is that the companies, the colleges, and the students all get what they need to prosper.

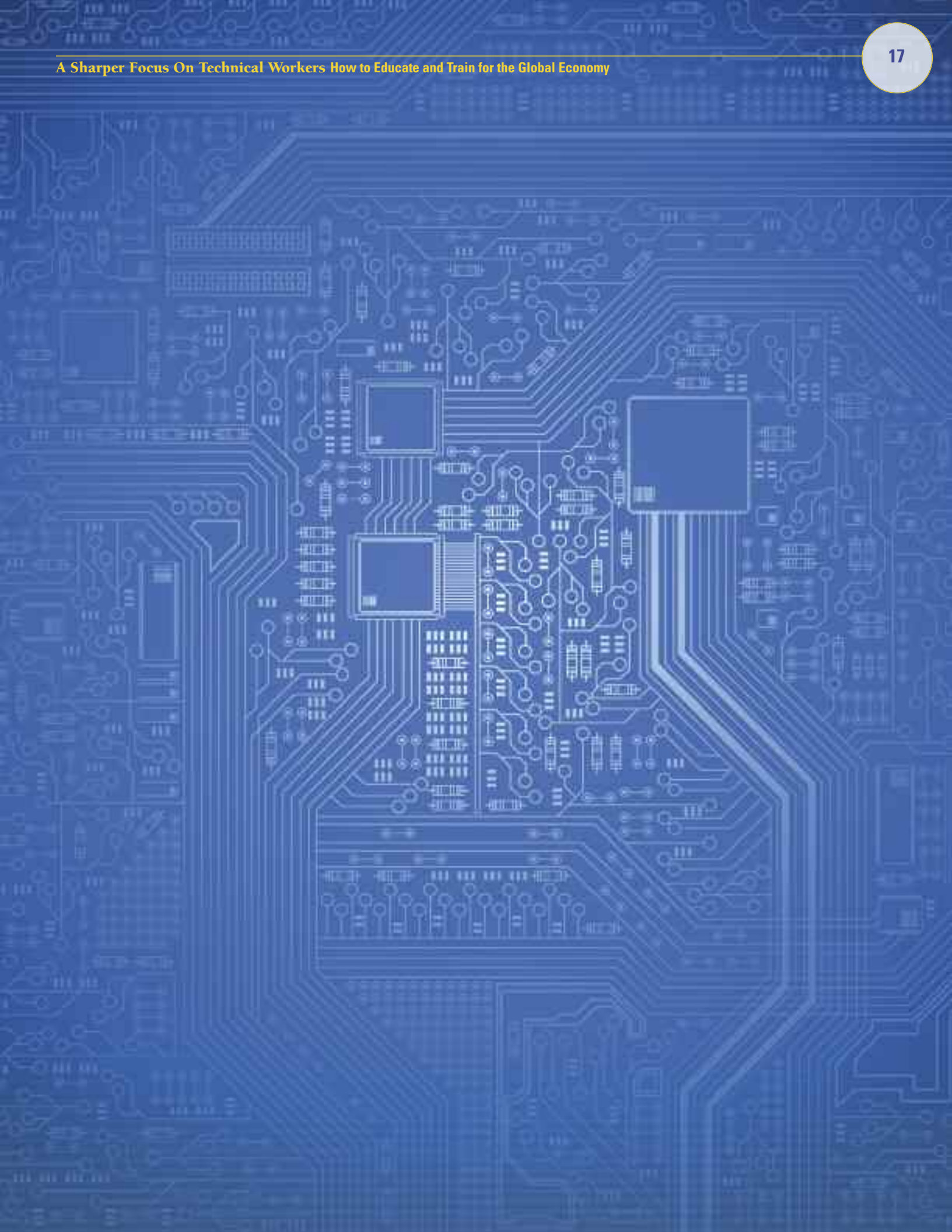
- Companies get a highly skilled workforce with the precise skills required to be globally competitive.
- Community colleges get a state of-the-art curriculum that, once created, can be updated efficiently on an ongoing basis and be packaged and re-packaged in many ways to serve many employers.
- Students receive highly targeted instruction that accommodates many learning styles. They finish their education ready for the environment of the modern factory, and they have portable, marketable skill sets that can be transferred to other businesses and industries. Just as important, they have access to ongoing technical education and the skills to continually learn and adjust to rapid changes in technology or their industry. They receive credit that can be applied to other educational goals they may have and achieve other credentials.

A Shift to Collaborative, Industry-driven Job Training

The Past	The Future
The Worker	
Technical workers are not considered to be knowledge workers and are not taught skills of the knowledge economy.	Every worker is considered a knowledge worker; technical workers are trained to be multi-skilled, creative problem solvers.
The Partnership	
Industry and educational institutions form one-to-one partnerships in an ad hoc manner with limited objectives.	Partnership is required—industry and education cannot be collaborative without a partner—and the collaboration works across states and institutions to achieve an audacious goal.
Federal and state policies tend to focus on crisis response to unemployment rather than a proactive model for career-oriented skills training.	Federal and state policies evolve in response to feedback and new data. Measurable outcomes are established in the development of partnerships, programs, and curriculum content and tracked.
The Education	
Job training occurs in a classroom or institutional setting.	Job training occurs in a contextual, work-like environment.
Curriculum is driven by academic expectations. Curriculum content is not designed to meet industry needs; thus, it is often irrelevant or out of date.	Curriculum is driven by industry needs. Curriculum content is based on industry standards and developed in close consultation with industry.
The content delivery system of two- and four-year colleges is ill equipped to address needs of those who have already begun their working lives.	The content delivery system is flexible, includes social supports for adult workers, and applies technology to improve productivity.

Meanwhile, states—and the United States as a whole—get what they need to create enduring prosperity. Most important, the states and the nation get:

- A path toward reclaiming an important role in manufacturing: a 21st-century role that involves new and more sophisticated workforce skills required for the high-value "advanced manufacturing" that has emerged in the last quarter-century.
- Large-scale transformation of training and higher education in ways that matter to overall prosperity, especially an important alternative to the standard academic four-year degree.
- A new and important path toward upward economic mobility for many people who can't afford or don't thrive in traditional academic settings, an important goal that has eluded both the nation and the states for several decades.



An Opportunity for Change: What Governors Can Do

There's a widespread belief these days that the problems facing states' economies—and workers—are beyond the control of the states themselves because they are determined by global forces. It has been widely assumed, for example, that any routine job—even a high-paying white-collar job—can be moved overseas. That's why recent economic development efforts have focused on extremely high-skilled jobs that involve creativity and innovation.

Yet the AMTEC case study suggests that states actually can have a great deal of control over their own economic destinies, especially in areas where highly-skilled technical workers must join forces with creative and innovative talent to produce goods and services that the American economy needs.

Even high-value economic sectors focused on innovation require a wide range of jobs; in turn, many of those jobs require a sophisticated technical education. For every highly trained chemist or biologist working on the next big biomedical breakthrough at a university or research institute, for example, there are many lab technicians who must have the same kind of problem-solving and critical thinking skills that automotive maintenance technicians must have. The same is true for health care workers such as nurses, who, like manufacturing maintenance technicians, work in fast-paced environments where they must make significant decisions in real time—and where technology and science are constantly evolving. These higher-level thinking skills represent the transferable competencies that all workers will need to keep them competitive in times of technological change and economic fluctuation.

And even in the manufacturing sector itself, it has become clear that technologically sophisticated high-value manufacturing—advanced manufacturing, as it is sometimes known—can thrive in the United States, which is still the largest market in the world for most manufactured goods.

States have significant control over a wide variety of policies associated with economic prosperity. (See the sidebar, "State Policy Role Related to Economic Prosperity.") But for most states, human capital is their greatest asset, and states have almost total responsibility for education and workforce development policies. Most governors recognize that they are at a disadvantage worldwide against countries that are rich in labor—including nations like India that are increasingly rich in well-educated labor—and that they must find a new approach to workforce preparation and transition in the United States. The AMTEC story suggests, arguably, that states have at their disposal the ability to build partnerships to grow and nurture highly skilled technical workers who help existing industrial sectors maintain an advantage against global competition.

With all this in mind, here is a list of actions governors can initiate to shape a new future for job training in a way that will nurture and grow its largest, most important, and—in many cases—fastest-growing industries.

State Policy Role Related to Economic Prosperity

Developing Talent

States have most of the money and most of the power to educate the talented people who work in our industries, businesses, and civic sectors: about three-quarters of all undergraduates are educated at public universities and community colleges.

Supporting Universities

States have most of the responsibility for research universities and research institutions—the places where much of the research and development that benefits this country is conducted.

Establishing Market Signals

States have authority to set policies and provide incentives that generate the market pull for new products and services for sectors across the economy (e.g., green products and services, health care).

Investing in Research and Development (R&D)

States have their own R&D funds and are making major investments in renewable energy, alternative vehicles, nanotechnology, etc., and increasingly using these investments to push new ideas to the marketplace, create new firms, and build capacity tied to the needs of regional industries.

Scaling Up Industry Collaboration

States are "pioneers" in cluster-based economic development, giving them strong partnerships for engaging all sorts of industry clusters (e.g., information technology, construction and real estate, biotechnology) in strategies to innovate together, support ambitious transdisciplinary initiatives, and build infrastructure that creates economic value for a critical mass of firms.

- **Champion the importance of technical education and technical work to economic competitiveness and worker prosperity.**

Between 40 percent and 45 percent of all job openings in the economy through 2014 will be in middle-skilled occupations that require postsecondary education and training but not necessarily a bachelor's degree.[12]

Making the public understand that technical work is part of the higher education system is a new concept. Governors value universities—particularly research universities—not only for the innovative breakthroughs that could lead to prosperity but also for the prestige and money they bring. Most governors come from professional careers such as the law or have MBAs.

Although community colleges are winning more attention from many governors, they are still not regarded as a priority. Yet, as this case study highlights, high-quality technical education, especially from community colleges, is likely to be the bread and butter of key sectors of our economy in the future: manufacturing, energy, engineering technicians, health care, and others. The single most important thing any governor can do is use his or her bully pulpit to value the importance of highly skilled technical work to the state's overall prosperity and convey the idea that technical jobs pay good wages and are solid career choices for many people.

- **Focus first on the industrial sectors where economic impact will be greatest.**

The most valuable credentials are those in quantitatively oriented fields or high-growth/ high-need occupations.[13]

Economic development efforts are always most useful when they are highly targeted. Governors need to use the economic analysis and development resources at their disposal to identify those industrial sectors that have the greatest potential and are most in need of the transformative collaboration with community colleges and industries. The next step, of course, is to get everybody together—companies, community colleges, and state economic development and workforce development agencies—to review existing programs and determine whether current resources can be better targeted to meet everyone's goals.

As such, the needs of sectors should be translated into competencies that are defined by industry leaders. Industry and community colleges can then work together to develop curricula based on these competencies. Translating the needs of sectors into competencies also provides flexibility for workers: the skills of workers become part of a career pathway that may be transferable to other sectors when one sector declines.

- **Use state spending to encourage community colleges to engage in collaboration and innovation.**

Community colleges rely on states and localities for the lion's share (nearly 60 percent nationally) of their revenues.[14]

Governors can begin to use their support of community colleges to reward those community colleges that meet state economic goals. The following requirements could be included:

- Collaborating with key industry sectors and matching curriculum to industry-set standards.
- Establishing mechanisms for granting credit for courses that have traditionally been noncredit and for prior learning (on the job). Postsecondary noncredit education has become increasingly common in recent years, and at many community colleges, noncredit programs enroll more students than do credit programs. Just nine states have guidelines for including noncredit courses on a transcript, with most leaving the decision up to each college.[15]
- Aligning industry apprenticeships with earning an associate's degree.
- Professional development programs that help instructors move to teaching multi-skilled problem solving in a hands-on environment.
- Implementing an innovative curriculum that is: divided into small learning modules; taught in a contextual learning environment; flexible in delivery; clear about standards for assessment and credentialing
- Evidence that international benchmarking is used in setting standards and designing curricula.

In addition to state funding sources, governors have some responsibility for the distribution of federal funding to community colleges. The Workforce Investment Act (WIA) includes a 10 percent discretionary fund for statewide activities. Ten percent of a state's allocation of Perkins Title I vocational and technical education funding is directed toward state leadership grants, money that can be used at the state's discretion.[16] For example, in 2009, Florida received $60 million in Title I Perkins funding and directed a little more than 8 percent of it—$5.6 million—toward state leadership projects.[17]

Governors could form an action plan for community colleges to strategically coordinate their federal workforce and education funding. This is an opportunity for governors to provide clear direction on how community colleges can coordinate their efforts to meet the industry and worker competitiveness and economic prosperity goals of the state. Rather than competing against each other for funding, community colleges would find areas of specialization or excellence to meet clearly defined state goals, such as increasing credentials in a high-growth sector of the state economy.

- **Develop multi-state partnerships focused on providing consistent, high-quality, industry-valued training.**

Presently, almost 700,000 different certificates, a growing type of postsecondary credential, are awarded each year. However, certificates and other credentials often have little or no value because they are not held to nationally or internationally accepted standards and are consequently not recognized by employers or education institutions.[18]

Governors are remarkably good at talking to each other about things that matter to them. The AMTEC model suggests that they can work together on innovative multi-state partnerships to improve technical education and build a common workforce that will help create enduring prosperity. Together, governors can remove barriers to interstate collaborations for curriculum development and work to establish high quality certificates in critical industries and businesses. When states have similar technical education needs, they can help each other scale up more easily in a wide range of industries. They can also cut costs by working together and being more responsive to individual companies and entire industries that cross state lines.

The demand for workers with industry-recognized certificates is particularly urgent across all states in the health care and green jobs industries. There are not enough skilled workers for health care and green jobs. Innovating in a few training programs at a time will not make enough of a difference. To truly scale up a learning program in clean energy, for instance, governors can build on this auto manufacturing example and deploy transformative collaboration to prepare workers for these important industries on a national scale. More precisely, governors of states with strong solar or wind sectors, for example, can form a collaboration that includes one community college and one significant company from each of their states and charge this multi-state group with identifying the best solar or wind industry training programs in the world; getting the standards, curriculum, and assessments right; and deploying them quickly to all the states and enabling a fast scale up of workforce certificates and training standards that meet industry needs.

Many states are also looking for guidance and information on how to streamline and rapidly expand quality training opportunities for those looking to enter the home energy retrofit industry. By collaborating, states can quickly facilitate the mobilization of a national home retrofit workforce. Furthermore, a consistent set of standards will increase consumer confidence in energy retrofit workers and stimulate rising demand for efficiency retrofit programs on a national scale.

- **Require comprehensive outcome data to assess students' skills and credentials gained, hold educational institutions accountable, and inform policymakers.**

There is widespread consensus that improved information on student outcomes is needed if the nation is to meet its ambitious educational attainment goals.[19]

The AMTEC model has standardized a common set of metrics for assessing student performance and outcomes that can be a building block for a comprehensive accountability system, showing whether higher educational institutions are meeting employers' and students' needs in terms of the knowledge and skills acquired and credentials attained. This system can make outcomes more transparent to inform the decisions of policymakers, employers, and workers and provide the data for evaluating and scaling up successful approaches.

Governors can take the following actions to improve the availability and use of information on student outcomes:

- Use financial incentives to reward progress in improving outcome data by adopting performance-based funding for a portion of higher education funding.
- Expand statewide data systems and develop a common set of metrics to measure student progress and success in ways that are tied to the needs of industry.
- Take advantage of the federal funds available through ARRA to develop and implement a statewide longitudinal data system to track student performance.
- Improve the dissemination of information by making better use of technology and developing report cards or dashboards that make data more transparent to students, employers, and policymakers.

Conclusion

Governors play a uniquely important role in workforce development because states oversee workforce investment and most higher education. And in the past few years, states have placed a major emphasis on both, recognizing the role of knowledge workers in the new economy.

The bottom line, however, is that every business is part of the new economy, and every worker needs more education and better skills to be part of the new economy. This undeniable fact requires governors to devote more time and attention to the whole arena of technical education and make sure that the workforce needs of their most important industries are being met in a way that is specific and responsive.

The AMTEC case study provides governors with a template they can use as they approach this challenge. The main lesson from AMTEC isn't that it is helping to train a competitive workforce in manufacturing or even that a factory and a community college can team up productively. The main lesson is that if technical education is carefully targeted to skills that important industries need and focuses on flexible learning of skills required by all players in that industry, then it is possible to scale up a workforce education program in any industry. The new economy requires not just white-collar workers but also workers with outstanding technical skills and highly developed problem-solving abilities. These workers will be the backbone of tomorrow's prosperity, and the need for them is so great that successful technical education must be replicated on a wide scale in industry after industry.

Endnotes

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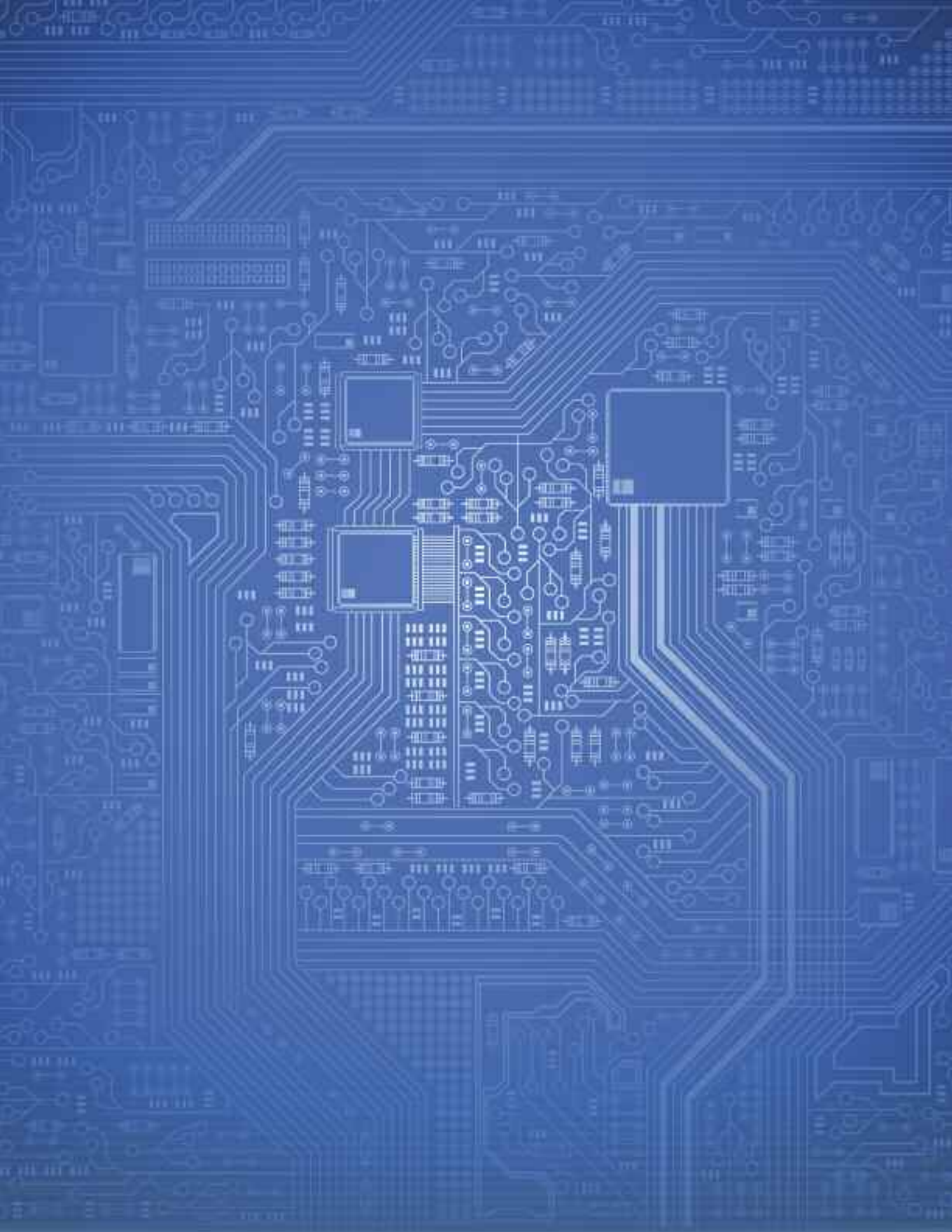


NGA CENTER DIVISIONS

The NGA Center is organized into five divisions with some collaborative projects across all divisions.

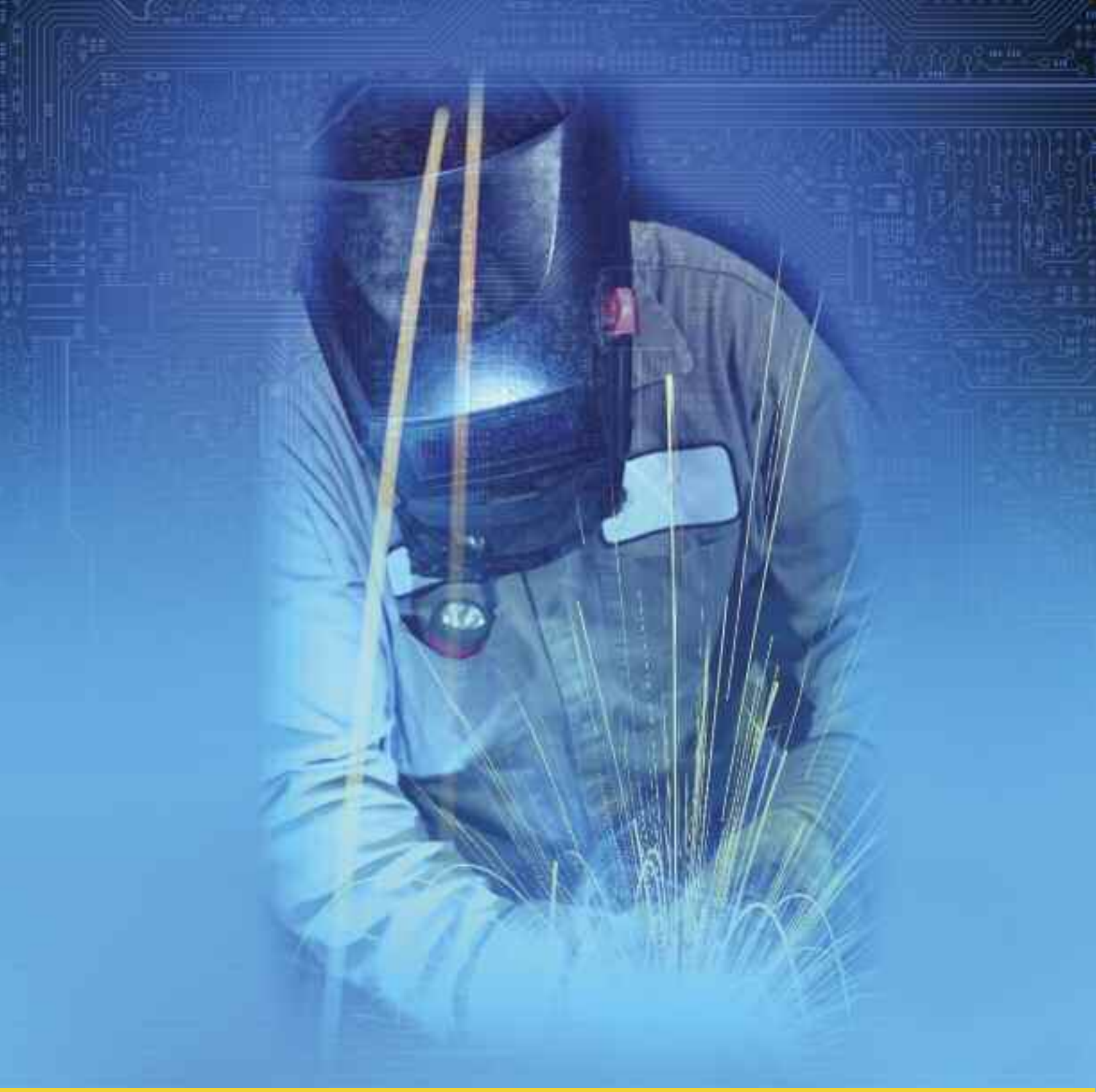
- **Economic, Human Services & Workforce** focuses on best practices, policy options, and service delivery improvements across a range of current and emerging issues, including economic development and innovation, workforce development, employment services, research and development policies, and human services for children, youth, low-income families, and people with disabilities.

- **Education** provides information on best practices in early childhood, elementary, secondary, and postsecondary education. Specific issues include common core state standards and assessments; teacher effectiveness; high school redesign; science, technology, engineering and math (STEM) education; postsecondary education attainment, productivity, and accountability; extra learning opportunities; and school readiness.

- **Environment, Energy & Transportation** identifies best practices and provides technical assistance on issues including clean energy for the electricity and transportation sectors, energy and infrastructure financing, green economic development, transportation and land use planning, and clean up and stewardship of nuclear weapons sites.

- **Health** covers a broad range of health financing, service delivery, and coverage issues, including implementation of federal health reforms, quality initiatives, cost-containment policies, health information technology, state public health initiatives, and Medicaid.

- **Homeland Security & Public Safety** supports governors' homeland security and criminal justice policy advisors. This work includes supporting the Governors Homeland Security Advisors Council (GHSAC) and providing technical assistance to a network of governors' criminal justice policy advisors. Issues include emergency preparedness, interoperability, cyber-crime and cyber-security, intelligence coordination, emergency management, sentencing and corrections, forensics, and justice information technology.



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