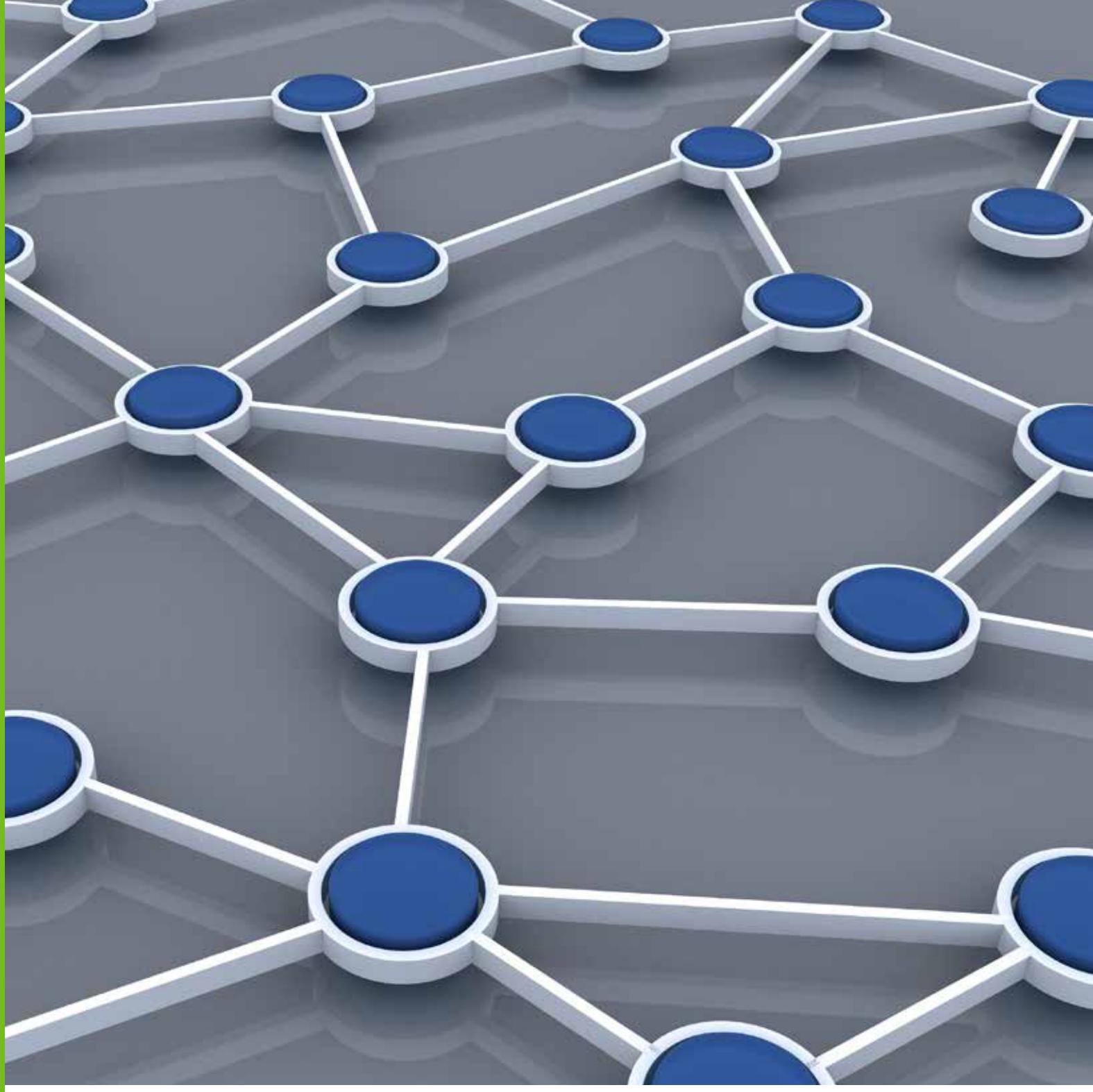

Making a Market for Competency-Based Credentials

CSW
Corporation for a
Skilled Workforce

Good Jobs. Thriving Communities.

Acknowledgments

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Executive Summary

Traditionally, employers, workers, and students have used academic degrees and diplomas as a proxy for the skills and knowledge needed to perform on the job. There is growing interest in the use of competency-based credentials to complement this tradition. High-quality, employer-backed, competency-based credentials can provide more precise information about job requirements and workers' proficiencies, particularly for the more technically skilled positions that make up an ever increasing share of the U.S. labor market.

Unfortunately, the current "market" for competency-based credentials is neither fully formed nor functional. A chaotic patchwork of sub-degree certificates, licenses and other credentials is offered by a confusing array of industry and occupational groups, third-party validators, and educational providers and systems. No national framework exists for developing and endorsing these credentials. Too few businesses, educational institutions, workers and students — the major players in such a market —understand or make use of competency-based credentials. Even in industries with mature credentialing efforts, the take-up rate by employers is not consistently high.

The Corporation for a Skilled Workforce (CSW) is embarking on a multi-year initiative to increase the quality and use of competency-based credentials across the country. In recent months, we have worked to lay the foundation for this new initiative by analyzing the credentialing landscape, identifying promising credentialing approaches, and assessing what is needed to create a healthy credentials marketplace. Our paper, *Making a Market for Competency-Based Credentials*, compiles what we have learned to date. This summary highlights key findings and recommendations from the full report.

Demand for Competency-Based Credentials Is High

Americans want the education system to focus more on learning and demonstrated competencies, and less on "seat time." According to a recent Gallup/Lumina Foundation poll:

- 87 percent of respondents said they believe students should be able to receive college credit for knowledge and skills acquired outside of the classroom.
- 75 percent indicated they would be more likely to enroll in a higher education program if they could be evaluated and receive credit for what they already know.
- 75 percent don't believe learning should be time based and agree that if a student demonstrates they have mastered class material in less than the traditional 16-week session, they should be able to get credit for the course without sitting through the entire 16 weeks.

For more information, see: http://www.luminafoundation.org/newsroom/news_releases/2013-02-05.html#sthash.WHSQ4Pp6.dpuf

Why Now?

Trends in philanthropy, public policy, education and the labor market are converging to create momentum for the expansion of competency-based credentialing. These diverse efforts add up to a big opportunity. With the right scaffolding in place, the market for competency-based credentials could produce a range of important benefits for:

- *Employers,* who can use high-quality competency-based credentials to inform hiring, deployment and promotion decisions and to ensure that relevant educational programs address their needs;
- *Workers and Students,* who will have the ability to better navigate career pathways and transitions and who can offer competency-based credentials as proof of their skills and knowledge;
- *Educators,* who will be able to better align their curricula with industry requirements and can then cite employer-validated credentials as evidence that they prepare students for in-demand jobs; and
- *Public policymakers,* who can foster more agile, thriving labor markets by supporting the development and attainment of competency-based credentials.

What Is the Current State of Play?

Our research revealed both real potential and troubling weak spots in the current credentials landscape:

1. **Market-relevant competency-based credentials are used for specific jobs in a number of fields,** such as healthcare and IT. But there is tremendous variation in how deeply embedded credentials are in different industries. Often, credentials are available but used only sporadically. And many credentials for specific jobs are *not* part of larger, well-defined career pathways.
2. **Widely used credentials have strong employer backing.** Where credentials have been most successful, employers have played a central role through the entire credential development process, from identifying competencies and skill standards, to developing assessments and ultimately recognizing and using credentials in hiring and advancement.
3. **Credential quality is inconsistent.** Many credentials lack third-party or industry validation to ensure their quality and relevance to workers and employers. There is widespread confusion about the elements of a quality credentialing process and the meaning of key terms, including "competency," "quality curriculum," and "assessment."

4. **Portability and transparency are key challenges.** To be useful, credentials must be both transparent—meaning information about how they were developed is easily accessible—and portable—meaning they are credible from job to job and region to region. Too few credentials currently meet these criteria.

5. **There are promising models of tiered/stackable/bundled credentialing systems.** These models allow workers and students to flexibly make their way through career pathways, moving in and out of education and training as needed, attaining credentials that document different competencies and advancing in their fields.

6. **Employers are often looking for "cross-functional" skills, like problem-solving and innovation, in addition to job-specific competencies.** There is broad agreement about the need to incorporate these basic employability skills in credentialing efforts, but little consensus about how to define or assess them.

7. **There are barriers to bringing competency-based and industry-recognized credentialing to scale.** These include insufficient data about the return on investment for employers and educators who use credentials; a lack of common definitions; and scant funding to support credentialing initiatives.

8. **There is no comprehensive policy framework for the expansion and replication of promising competency-based credentialing policies and practices.** Numerous federal departments and agencies are engaged in developing, using and/or supporting credentialing processes, but these efforts are not connected by any unifying policy agenda.

Building the Market

This paper suggests a number of strategies to address these issues and create a more viable market for competency-based credentials. These include:

- **Ensuring quality—**Drawing on conversations with industry, education and workforce policy experts, the paper outlines the core elements of a quality, industry-validated, competency-based credentialing process. This section also examines the role of external accreditors and validators, who can help ensure that credentials are developed in accordance with the quality standards outlined.

- **Expanding use by employers**—Key strategies include documenting the return on investment (to show that the time and effort to engage in credentialing work pays off) and involving staff at all levels within participating firms (CEOs, plant managers, frontline supervisors, human resources staff, etc.). This section presents specific recommendations for industry associations, consortia, and sector partnerships to become more involved in credentialing efforts.

- **Expanding use by workers and students**—To make credentials useful for students and workers, it is vital to demonstrate they are valued by employers and that they can lead to new job opportunities, promotions and/or raises. Making credentials stackable and accessible (in terms of time and money) and including basic employability skills as part of well-defined career pathways is also critical.

- **Expanding use by educators**—Relatively few schools are actively working to advance the broad-scale use of high-quality competency-based credentials. This is unfortunate, because colleges that expand their use of such credentials can strengthen relationships with local employers, build more integrated and effective education and workforce development systems, and improve outcomes for students. This section outlines a number of ways that educational institutions can help drive competency-based credentialing efforts.

- **Creating a scaffolding or infrastructure to help the credentials market flourish**—This infrastructure can promote common, consistently used definitions of key terms; provide quality assurance mechanisms and transparent information for consumers about how credentials were developed; advocate for needed federal, state and institutional policy changes; and foster better communication and coordination among existing competency-based credentialing efforts.

Conclusion

In addition to the strategies highlighted above, this paper enumerates several initiatives that could be undertaken at the federal level to support the growth of a well-functioning credentials market. It also describes "bottom-up" (i.e., regional and institutional) and "top-down" (i.e., national- and state-level) approaches that stakeholders could leverage, even without federal action. Bringing high-quality, competency-based credentials to scale is an ambitious but achievable goal. To make it happen, industry associations and consortia, regional sector partnerships, educational institutions, external validators, and public and private funders all have critical roles to play. Happily, each of these actors also stands to yield significant benefits from a thriving credentials market—as do American workers and the economy as a whole.

Competency-Based Credentialing: Urgency and Opportunity

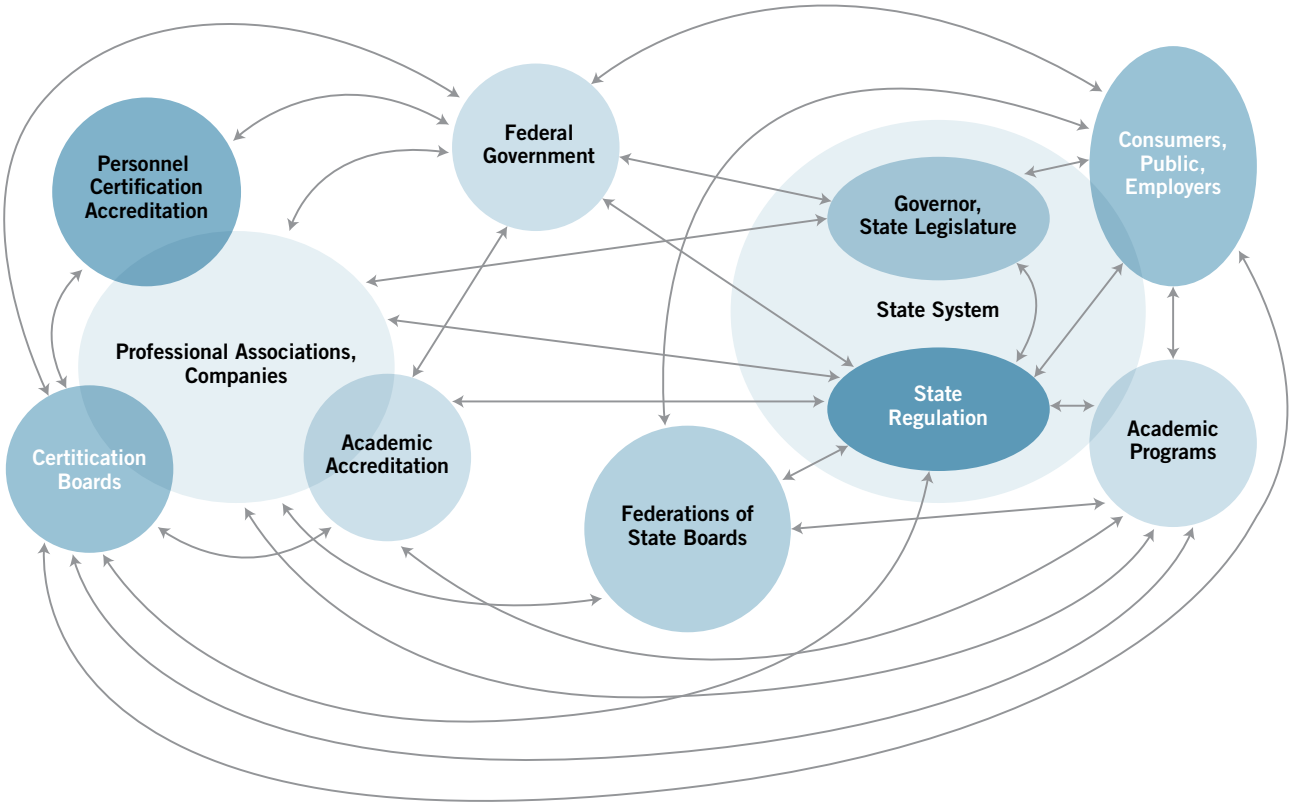
Just a few years ago, a high school diploma was, for many Americans, a ticket to a decent job. This is no longer the case. A large and growing share of the U.S. labor market is made up of jobs that require strong technical skills and related postsecondary education. These jobs are at the heart of our new economy and include, for example, positions in high-tech manufacturing, information technology, healthcare, and clean energy. Skilled workers to fill these positions are vital to the success of America's businesses. And the postsecondary training that prepares people for these jobs, as well as the credentials that communicate resulting competencies, can open the door to steady, family-sustaining employment for millions of Americans.

Unfortunately, people interested in boosting their skills often have difficulty finding clearly mapped training and career paths. Many workers can't "get credit" for training they have already completed and skills and knowledge acquired in prior jobs. Their learning doesn't count toward higher education degrees and frequently is not recognized when they move from one job to the next. This situation creates challenges for businesses as well. Many report that they have trouble identifying workers with the right skills, particularly for positions where there are few well-defined and widely used credentials.

The current chaotic patchwork of credentialing systems is not effectively serving businesses, workers, or students. Sub-degree certificates, licenses and other credentials are offered by a confusing array of industry and occupational groups, third-party validators, and educational providers and systems. Every state has unique licensing requirements for various industries, and 39 accrediting agencies are involved in the creation and validation of credentials that are currently in use. (See graphic on page 8.)

The U.S. desperately needs a more coherent competency-based credentialing system, to ensure that businesses and job seekers get the most out of postsecondary training, both informal and formal, whether offered by educational institutions or other organizations. Given the complexity of current offerings, the multitude of players involved, and the rapidly changing skill requirements of employers, this can seem like a daunting, perhaps unachievable goal. But progress is being made in a number of fields, and there is now great potential for the large-scale adoption of competency-based credentials.

Credentialing System in the United States



Source: American National Standards Institute (ANSI)

The Opportunity (and the Challenge)

Traditionally, employers, workers, and students have used academic credentials (degrees and diplomas granted by high schools, colleges or universities) as a proxy to show competence for job skills and knowledge. But these credentials have primarily been based on "seat time" and the "credit hour" as the key marker of competence. There is increasing awareness that this approach is inadequate.

Complementing traditional degrees with an array of high-quality, employer-backed, competency-based credentials can provide more precise information about job requirements *and* worker skills. Experience in the U.S. and other nations suggests that competency-based credentials have the potential to benefit a range of players, including:

- *Employers,* who can use credentials to improve the effectiveness of their hiring processes, to inform deployment and promotion decisions and pathways, and to ensure that curricula in relevant educational programs reflect their needs;

- *Workers and students,* who can use competency-based credentials as proof of their skills and knowledge, and to improve their ability to navigate career pathways and transitions, both within and across industry sectors (this includes returning veterans, who often find it difficult to document competencies gained through military service);
- *Educators,* who can use employer-validated credentials as evidence that they prepare students for in-demand jobs and to ensure their curricula is well aligned with requirements of key industries; and
- *Public policymakers,* who can foster more agile, thriving labor markets by supporting competency-based credentials.

Credentialing processes built on standards-based competencies, curricula, and assessments can prepare workers and students at all levels to meet the demands of the modern labor market and can help ensure that businesses have the human capital they need to flourish. For this reason, increasing numbers of policymakers, philanthropists, employers and education leaders are focused on developing credentials that align with specific industry standards—replacing seat-time with competency-based credentials.

The challenge is that no national framework exists for developing and ratifying credentials. The "market" for competency-based credentials is not fully formed or functioning. Too few businesses, educational institutions, workers and students—the major players in such a market—understand or make use of such credentials. Even in industries with mature credentialing efforts, the take-up rate by employers is not consistently high. Those who pursue credentialing often find it messy, confusing, and inconsistent. And current efforts to develop credentials in different industries and different parts of the country are largely disconnected. This environment has made it nearly impossible for policy leaders and practitioners to discern what works to ensure the quality and market relevancy of credentials at all levels—degrees, diplomas, industry certifications, other certificates or other types of credentialing mechanisms.

Our Response

The Corporation for a Skilled Workforce (CSW) is embarking on a multi-year initiative to increase the quality and use of competency-based workforce credentials across the country. We are conducting this work in close partnership with national policy groups, foundations, and leaders at the national, state and local level who are equally committed to advancing the use of quality competency-based credentials. We are convinced that the time is right to undertake a series of strategies across the nation that can substantially scale up the adoption of competency-based credentialing.

Why Now?

Changes taking place in philanthropy, public policy, education and the labor market are helping to create a tipping point for the expansion of competency-based credentialing:

- **The pronounced shift toward outcomes-based performance measurement** and away from input-oriented measures (e.g., the time-based credit hour) has spurred interest in a competency-based credentialing framework that could measure learning more effectively.
- **The current rapid expansion of Massive Open Online Courses** (MOOCs) has begun to reveal the potential for de-institutionalizing learning, unbundling instruction and content, and using alternative learning models and "micro-credentialing systems" (e.g., Digital Badges[1]) to validate credentials.
- **Industry-driven efforts**, such as the National Association of Manufacturers-led Manufacturing Skills Credentialing System, are encouraging the use of industry-validated credentials.
- **Education-led efforts** are showing how competency-based credentials can promote student success and help educational institutions achieve their mission.
- **Initiatives led by standards-setting organizations** are advancing thinking about credential rigor and validation, including multiple efforts led by the nonprofit American National Standards Institute (ANSI).
- **Foundation-led initiatives** in support of crucial research and development and research and policy work by a range of organizations are also contributing to the momentum.
- **Federal interest**, spanning nearly every department, is adding legitimacy and support for expanding the use of competency-based credentials.
- **State experimentation** with the incorporation of competency-based certificates into financial aid and performance management systems are providing valuable experience and lessons.

These diverse efforts add up to a big opportunity. By cultivating a marketplace where the many players can come together, collaborate and "do business," we can dramatically increase the quality and use of competency-based credentials. This, in turn, will bring benefits for employers, workers and educational institutions alike.

In recent months, we have worked to lay the foundation for this new initiative. We scanned and analyzed the credentialing landscape to highlight promising credentialing processes, identify their common elements, and assess what is needed to advance and grow this work. In the course of our research, we conducted personal interviews, case studies, and literature reviews (see Appendix A). In October 2012, we convened a group of national and regional experts to discuss our initial findings and get feedback about possible next steps (see Appendix B).

This paper compiles what we have learned to date. It describes the current state of play in competency-based credentialing. It then outlines components of a quality credentialing process, and explores how a market for such credentials could be effectively nurtured and brought to scale—by engaging businesses, workers and educational institutions. Finally, the paper proposes a number of strategies to expand the use (and *usefulness*) of competency-based credentials. Our hope is that this work can serve as a roadmap for representatives from the business, education and policy sectors to move competency-based credentials from sporadic use in select fields to a core part of the education and labor market landscape.

Examining the Current Market for Competency-Based Credentials

CSW's scan of the field revealed promising efforts to develop and increase the use of competency-based credentials around the country, as well as real barriers that are impeding the healthy functioning of a credentials marketplace. In this section of the paper, we describe the current state of competency-based credentialing, highlighting aspects of the nascent market that are working and those that are not.

Demand for Competency-Based Credentials Is High

Americans want an education system that is focused on learning and demonstrated competencies, rather than "seat time." According to a recent Gallup/Lumina Foundation poll:

- 87 percent of respondents said they believe students should be able to receive college credit for knowledge and skills acquired outside of the classroom.
- 75 percent indicated they would be more likely to enroll in a higher education program if they could be evaluated and receive credit for what they already know.
- 75 percent don't believe learning should be time based and agree that if a student demonstrates they have mastered class material in less than the traditional 16-week session, they should be able to get credit for the course without sitting through the entire 16 weeks.

For more information, see: http://www.luminafoundation.org/newsroom/news_releases/2013-02-05.html#sthash.WHSQ4Pp6.dpuf

What Is the State of Play?

Our research suggests a number of insights and reflections about today's market for competency-based credentials:

1. **Market-relevant competency-based credentials are widely used for specific jobs in a number of fields.** For many years, industries like healthcare and information technology have relied heavily on competency-based credentials. These credentials were developed and gained prominence in a variety of ways. Healthcare credentials for positions such as Certified Nursing Assistants or Emergency Medical Technicians are closely tied to state regulations and the efforts of influential professional associations. For credentials in IT, some—like CompTIA's A+ certification[2]—were "pushed out" by a training vendor and slowly gained acceptance as employers realized their value. Other IT certifications were driven by industry software providers like Microsoft

and Cisco. These examples suggest no single path exists for how other industries can scale up the use of competency-based credentials. They do, however, suggest some general elements of a quality credentialing process, which are outlined below. They also show what is possible when credentials become widely used across a critical mass of employers within a given industry.

Indeed, there is a continuum of how deeply embedded credentials are in different industries, with healthcare occupying one end of the spectrum and numerous other industries where they're not used at all at the other end. For industries that fall somewhere in the middle, competency-based credentials are available but used unevenly. Sometimes there are several competing credentials for the same skill set, as well as questions about whether a given credential reflects periodic reassessment of the holder's skills to ensure they are still relevant. All of this can create uncertainty for both workers and employers.

Finally, while there is a long history of credentials for occupation-specific skill set (i.e. welding), this approach is increasingly viewed as insufficient to meet the demands of today's economy. Many of those we spoke with cited the need to embed these occupation-specific skill sets in a broader base of skills and credentials along well-defined career pathways.

2. **Widely used credentials have strong employer backing**. Where credentials have been most successful, employers have played a key role through the entire credentialing process–during the identification of competencies and skill standards, the development of assessments and, ultimately, in the actual recognition and use of credentials in decisions about hiring and promotion. Representation from different levels of the business community is critical. CEOs, plant managers, frontline supervisors and human resources staff bring varying perspectives and priorities to the process, all of which are important for a credential to become widely accepted.

Various configurations of employers can help drive the credentialing process. For example, **national industry associations and consortia**, such as the National Association of Manufacturers[3] (NAM), the Center for Energy Workforce Development[4] (CEWD), and the Interstate Renewable Energy Council[5] (IREC), work to identify core skill standards for their industries (or as in the case of NAM, vet and recognize existing industry-based credentials) in order to ensure that credentials are market relevant to employers.

Regional industry sector partnerships are another viable locus for credentialing work. These partnerships bring together employers within their industries, as well as government, education, economic development, labor, and community organizations, to identify and address regional labor market needs. There are a growing number of such partnerships around the country, and they are a natural place for

The Northeast Pennsylvania Logistics and Transportation Industry Partnership has identified core workplace competencies and skills for the state's logistics and transportation industry. The partnership, which includes employers, local Workforce Investment Boards, economic development organizations, and local colleges, developed training in basic supply chain management as well as two more specialized career pathways: facility and mobile equipment maintenance and warehousing and distribution center services.

developing, customizing, recognizing and using competency-based credentials. Examples include the Northeast Pennsylvania Logistics and Transportation Industry Partnership[6] and the Harper College partnership[7], both of which have brought together diverse players to create training that meets business needs and creates flexible career pathways for workers and students. Our research suggests, however, that these efforts are the exception rather than the rule: credentialing initiatives led by sector partnerships have, to date, been limited.

In fact, the majority of industry-driven credentialing efforts appear to have been undertaken either by industry associations and consortia or by sector partnerships that were initially focused specifically on industry standards, rather than broader workforce issues.

3. **Credential quality is inconsistent.** As it stands, too many credentials are self-declared as valuable by the organization issuing them. These credentials lack third-party or industry validation to ensure their quality and relevance to workers and employers. A wide range of approaches are used to develop the curricula for these credentials, with many having little connection to the skills and competencies needed by employers. Especially troublesome is a lack of common understanding about what constitutes a quality credentialing process and inconsistent definitions of key terms, including "competency," "quality curriculum," and "assessment."

   Because of these inconsistencies and uneven quality across credentials, there is confusion among workers and employers about their value. Most credentials provide little assurance that they truly represent the attainment of key competencies that are needed by businesses. Common language and standards for developing and continuously validating high-quality credentials will be crucial to the growth of credentials markets.

4. **Portability and transparency are key challenges.** Workers need to know that the credential they obtain will be valued by employers across their region and the nation, not just in their local area. Likewise, employers need to be confident that a credential from an institution with which they are not familiar signifies the same level of skill that they expect from credentials and institutions known to them, and that the competencies attained are aligned to their workforce needs. In many industries, credentials lack this kind of portability from job to job or region to region.

   The current policy environment would make "national standards" (outside of sector strategies in specific industries) difficult to achieve, but credentials can at least be *transparent* across the country, regardless of the level at which they're initially created. Transparency means workers and employers can easily access information about how the credential was developed and what a worker or student has to do to obtain it. Transparency helps ensure that credentials are credible across contexts, and therefore portable.

Harper College, a community college in Illinois, recently launched a program allowing students to earn industry-endorsed certificates in manufacturing. More than 50 companies have agreed to hire students as paid interns as soon as they complete the first-level certificate, which can be earned in less than four months. Students can then continue their education and work toward more advanced certificates or degrees at their own pace.

Some credentialing efforts have begun to effectively address these challenges. For instance, the American Recovery and Reinvestment Act enabled hundreds of initiatives around the country to create regional training and career pathways in energy efficiency and weatherization. Many of them used the national Building Performance Institute (BPI) certification[8], which requires both a written test and field test, to document competencies for their training participants. Likewise, credentials promoted by the Pacific Northwest Center for Excellence on Clean Energy[9] (PNCECE), the American Water Works Association[10] and the Water Environment Federation[11], and NAM provide evidence that voluntary, business-driven, multi-state job task analyses can lead to credentials that are relevant across state and regional lines.

On the international front, there is growing demand for transparent sector-specific competencies and occupational qualifications, and more and more countries are treating up-to-date industry skill standards, assessments, and training as critical aspects of global competitiveness. Germany, for example, has engaged in a process in which identifying industry skill standards and building an appropriate curriculum is truly viewed as a *joint responsibility* among industry, government, and labor unions. This joint process has produced highly transparent and portable credentials with strong value in the marketplace—in Germany and across Europe.[12]

5. **There are promising models of tiered/stackable/bundled credentialing systems for a growing number of career pathways.** Our research shows that several credentialing efforts – including those by the U.S. Department of Labor[13], PNCECE, NAM's Manufacturing Institute and the CEWD[14] – use tiered systems to assess and credential employee skills. These tiered/stackable models provide opportunity for career advancement, allowing workers and students to flexibly navigate career pathways as they move in and out of education and training and attain credentials that document competence in various skill areas. This may be especially important for disadvantaged individuals with limited experience and education who need to build up skills over time, often while working.

   Stackable credentials are not limited to vertical, linear career pathways. Credentials can also be "bundled" to allow horizontal career movement (lattices), enabling workers and students to move across occupations and/or related industries. Tiers can include academic skills, workplace readiness skills, and foundational industry requirements, in addition to occupation-specific competencies. They can encompass secondary education and adult education pathways, as well as more traditional postsecondary options. For example, the U.S. Department of Education's system of secondary Career and Technical Education (CTE) includes pathways in 16 career clusters[15] that are often aligned with postsecondary

PNCECE (the **Pacific Northwest Center for Excellence on Clean Energy**) has developed numerous skill standards for the energy industry. It began in Washington State and has grown into a successful five-state regional collaborative, which includes representatives from industry and labor. Among its core goals are "providing clear education and career pathways for students and job seekers" and "creating a competitive workforce pipeline."

options. In this model, credentials can be independently attained in any one of the tiered skill areas (e.g., ACT's National Career Readiness Certificate documents foundational skills in applied math, reading for information, and locating information), and then "stacked" or bundled to provide evidence of competency attainment across skill areas.

6. **Employers are often looking for "cross-functional" skills, like innovation and problem-solving, in addition to job-specific competencies.** In our fast-changing economy, occupational and technical skill requirements can change regularly. But employers stress the importance of more durable, flexible skills as well. They need workers who can innovate, think critically, identify and solve complex problems, and work well in teams. This reflects a converging global demand for a workforce with multiple, cross-functional skills and for individual workers who can learn and apply knowledge in new situations (moving beyond being an "expert" to "adaptive expertise," which allows one to identify and solve problems in different contexts).

   These broad foundational learning and problem-solving skills should be among the building blocks in a stackable credentialing system. Although there is broad consensus on the need for developing these employability skills, there appears to be no agreement on common definitions or the means for assessing these skills. One related assessment tool that has gained some traction is ACT's Work Keys®—with certification offered through the National Career Readiness Certificate Plus[16] (NCRC Plus). Developing stronger ways to build and assess these cross-functional skills and incorporating them into various credentialing efforts will help fuel the credentials market.

7. **There are barriers to bringing promising competency-based industry-recognized curriculum and credentialing to scale.** Early adopters like like Automotive Manufacturing Technical Education Collaborative[17] AMTEC and PNCECE (and their strong industry partners) attest to the effectiveness of well-developed industry standards and their related curricula, assessments and credentials. Although our research indicates that national business associations and regional sector partnerships show significant promise as leaders of this work, broadly accepted standards-based credentialing efforts that are constantly up-dated to retain their validity are not yet a reality. Several significant barriers impact the ability to take these efforts to scale, including:
   - Insufficient data about the return on investment to demonstrate credentials' value to industry partners;
   - A lack of common definitions of industry skill standards and competencies;
   - A lack of reliable and leveraged funding streams to support national, state, and regional credentialing initiatives; and
   - A lack of time and resources to build *and successfully market* high-quality credentials and their related components.

AMTEC (the Automotive Manufacturing Technical Education Collaborative) is a multi-state, multi-college, multi-company sector partnership that is working to align its industry-based, modularized curriculum with the National Association of Manufacturers-endorsed Manufacturing Skills Certification System. The collaborative began as a customized training project of Toyota and the Kentucky Community and Technical College System and grew into an automotive sector partnership that includes other American, Asian, and German auto manufacturers. Today the AMTEC partnership includes 32 community colleges as well as labor organizations across 13 states.

8. **There is no comprehensive policy framework for the expansion and replication of promising competency-based credentialing policies and practices.** In recent years, many policymakers have honed in on the urgent need to increase the proportion of U.S. workers who attain a postsecondary credential. Research makes a compelling case that achieving that goal is essential for U.S. economic competitiveness, for businesses to thrive thanks to a skilled and agile workforce, and for individual workers to obtain and keep good jobs. There is also increasing recognition that competency-based credentials represent an important dimension of the postsecondary (as well as secondary) education and career pathway picture.

   Yet, the use of competency-based workforce credentials remains episodic rather than systemic, and there is no overarching policy framework for monitoring or expanding the use and quality of these credentials. Numerous federal departments and agencies are engaged in developing, using and/or supporting credentialing processes, including the Departments of Education, Labor, Health and Human Services, Defense, Energy, Justice and the Veteran's Administration, among others. A multitude of federal and state regulations and funding streams affect credentials in different industries. But these efforts are not connected by any unifying policy agenda or overarching goal. As we discuss in more depth in the concluding section of this paper, developing a national policy framework around competency-based credentials will be an important step toward bringing them to scale.

Looking Ahead

Although there are many promising examples and much momentum around competency-based credentials, the current marketplace is far from flourishing. As described above, a number of issues hinder the market's functioning, including uneven quality, a lack of common definitions, inadequate transparency and portability, and a lack of philanthropic and policy support. The following sections of the paper explore strategies to help the market grow, thereby enhancing the scale and usefulness of these credentials for all the key players.

Ensuring the Quality of Competency-Based Credentials

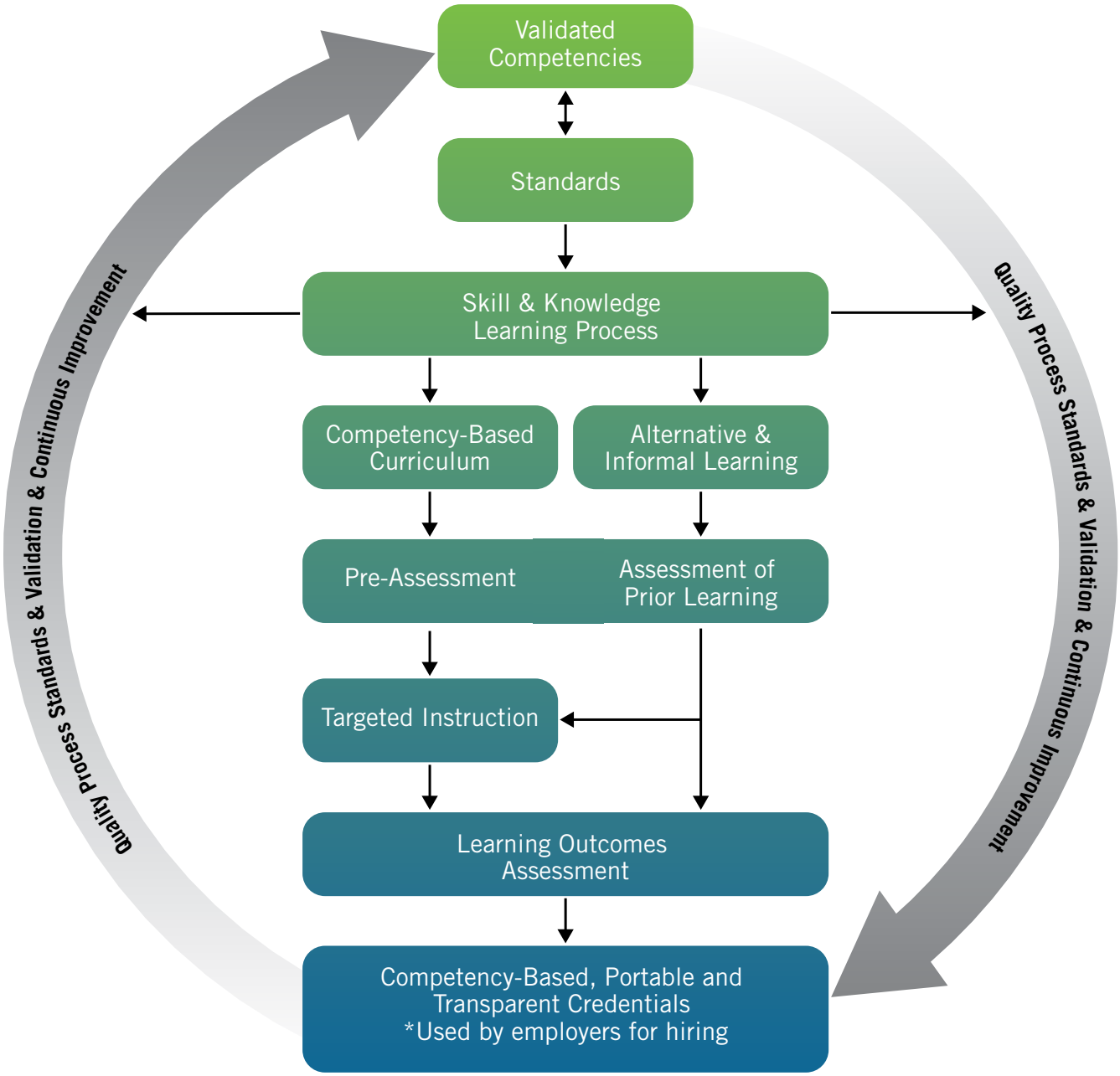
One of the fundamental weaknesses of the current credentials market is a lack of consistent quality. Many credentials are developed without adequate industry engagement or rigorous, structured processes for identifying competencies. This section of the paper draws on our conversations with industry, education and workforce policy experts to outline the core elements of a quality, industry-validated, competency-based credentialing process. It then explores the role of external accreditors and validators, who have the potential to ensure that credentials are developed in accordance with the quality standards outlined—and thus have real value for workers, employers and educators alike.

What Are the Core Elements of a Quality, Competency-Based Credentialing Process?

Our study strongly suggests the need for a consensus among key stakeholders—including educators, workers, policymakers and all levels of the business community—about both the value of a competency-based credentialing system *and the basic elements of a quality credentialing process.* Many of those we talked to agreed that a formal structured process, such as a Job Task Analysis, is essential to ensure the quality and portability of a credential. A Job Task Analysis identifies the core knowledge areas, critical work functions, and/or skills that are common across a representative sampling of practitioners or job incumbents, often known as "subject matter experts." The results from the job analysis provide the basis of a valid, reliable, fair and a realistic assessment that reflects the skills, knowledge, and abilities required for competent job performance. As one international expert told us, the key is for competencies and related credentials to be "empirically based" and industry driven, which could include alternate methods for identifying competencies, such as workplace observations.

In essence, a high-quality credential provides good evidence that the holder has the knowledge, skills and abilities to perform at the level employers want and expect. So, what does it take to achieve this outcome? Based on our many conversations, scan of the field and literature review, we developed the following model outlining the essential components of a quality credentialing process as well as the accompanying list of definitions. These depict the basic steps/practices needed to build a high-quality competency-based credential, and should provide a good framework for industry partnerships and training providers of all kinds, even as we work toward a stronger national consensus about credentialing.

A Quality Competency-Based Credentialing Process



Definitions of Core Elements

Validated Competencies

A measurable pattern of acquired knowledge, skills, abilities, behaviors, and other characteristics that an individual needs to perform work roles or occupational functions. Competencies are both general and technical:

- General competencies reflect the cognitive and social capabilities (e.g., problem solving, leadership, etc.) required for job performance in a variety of occupations and work roles.
- Technical competencies are more specific and are tailored to the particular knowledge and skills necessary for the specific occupation or work context.
- Competencies are the foundational building blocks in developing curriculum and industry skill standards. Competencies should be derived from a formal structured and empirically based process (e.g., a Job Task Analysis) with full participation of industry subject matter experts.

Industry Standards

The specified levels of proficiency and importance of different competencies (knowledge, skills, and abilities) that an individual needs to perform in the work-place. Standards can be used to delineate what a person must know and be able to do in order to perform work at a specific job, occupation, or across multiple functions.

Skill & Knowledge Acquisition

Skills and knowledge can be acquired through formal, institutionally developed and delivered instruction or informal experiential or self-directed learning:

- ***Competency-Based Curriculum*** is the set of courses, course work, and content needed to reach learning outcomes that are aligned with industry-driven competencies and skill standards when formal learning is an essential requirement. Competency-based curriculum refers to explicit learning objectives and is not seat-time based; it facilitates articulation between different levels of programs and non-credit and credit-bearing instruction and thus helps students progress more easily along educational and career pathways. Instructional delivery must be flexible and responsive to the individual needs of the learners. A flexible instructional delivery considers: scheduling; appropriate modalities of instruction; the role of technology and simulation; and types and timing of formative (measuring interim skill acquisitions) or summative (measuring final learning outcomes) assessments, as well as what levels of student performance are expected.
- ***Alternative and Informal Learning*** exists outside of traditional educational institutions. Students and workers have numerous other opportunities to acquire the knowledge, skills and abilities they need to pass competency-based assessments and earn credentials. Some of these alternative methods include "credit for prior learning" models, military and apprenticeship experience, work-based learning, and MOOCs.

Definitions of Core Elements (continued)

Assessment

Assessment is the process of measuring and documenting an individual's competence and a demonstration that she or he has the knowledge and skills necessary to perform required job functions. The learning objectives form the basis for developing the assessment. Assessments can be performed on a diagnostic basis as a pre-assessment, as an assessment of prior learning, and as a learning outcomes assessment that follows targeted instruction to document skill and knowledge acquisition. The most effective assessments are deeply embedded at all stages of the learning process. In a quality credentialing system, competency attainment and competency-based assessment must replace the proxy of "seat-time" or the credit hour as the primary metric for credential attainment.

Credentials

Credentials are indicators of skills and knowledge gained by an individual at different levels of the learning continuum through measurement, assessment, and documented skills acquisition. The term "credentials" is an umbrella term that includes degrees, diplomas, licenses, assessment-based certificates, badges, and professional/industry certifications. As articulated in U.S. DOL TEGL 15-10 – these credentials can be "stacked" as "part of a sequence of credentials that can be accumulated over time to build up an individual's qualifications and help them to move along a career pathway or up a career ladder to different and potentially higher-paying jobs."

Quality Process Standards

Standards governing *how* the credential is developed, include the *process* for developing the competencies, standards, curriculum, validation and assessment, for aligning learning systems (including formal institution-based learning and more experiential learning), and deploying the credential.

Validation

Quality credentials require validated documentation by a third party (e.g., ANSI) or industry as evidence that a person is competent to perform the skills as reflected in the specific credential. Currently, the vast majority of credentials have no third-party or industry validation; rather, the granting educational institution or training provider issues them based on "seat time" or instructor/institution-validated attainment if assessment of prior learning is being utilized.

Continuous Improvement

The ongoing review and modification processes that ensure credentials and their related components (competencies, skill standards, curricula, and assessments) remain updated and market relevant as skill-set requirements change. Continuous improvement activities enable organizations to enhance their ability to offer quality training/education and credentials. The spirit of continuous improvement also helps students/workers to engage in lifelong learning activities that enhance their knowledge and skills and demonstrate continued competence.

What Is the Role of External Validators?

Current quality assurance mechanisms are lacking. Traditional credit-based degrees and certificates are regulated by national and regional accreditation organizations, which have struggled to adapt to competency-based approaches. Noncredit certificates and industry and professional certifications are regulated in inconsistent ways by a variety of state government agencies, accrediting bodies and professional associations. And newer skill documentation approaches such as "badges"[18] are operating outside of these frameworks altogether.

External validators and accreditors have the potential to ensure that competency-based credentials meet the quality standards outlined above. Yet, according to ANSI, only 5 percent of certifications now have third-party validation. Creating new structures to safeguard quality is therefore vital to building a better market for credentials.

There are multiple dimensions of quality that impact a credential's credibility and usefulness:[19]

- **Process Quality**—how the credential is developed, to include the process for developing the competencies, standards, curriculum, learning systems alignment and validation, assessment, and deployment.
- **Content Quality**—the quality of the actual competencies and standards that are the basis of the credential. This would include verification and authentication of content for the intended use or scope of the credential.
- **User Quality**—usability and effectiveness for achieving the intended purpose of the credential, which would include both objective (metrics) and subjective (perceived value) factors.

Credentials need to be strong across all three of these dimensions to be trusted by employers, workers and educators.

The following approach to quality assurance could be considered at a national level:

1. A national body could develop high-level quality criteria/standards that are relevant for all credentials (or basic credential elements). ANSI could facilitate the development of the quality criteria/standards through their American National Standards process, Essential Requirements[20], which is a well- recognized process by both the private and public sectors. These criteria/standards should address the three dimensions described above – process, content, and user quality.
2. Credential developers could seek and obtain specific "quality accreditation" from an accreditation body that is nationally or internationally recognized.[21]

How AMTEC Approached the Core Elements of Quality

1. **Job Task Analysis (job Profiling):** AMTEC identified the initial knowledge, skills and abilities competencies for multi-skilled maintenance workers in the modern automotive manufacturing production process, using the (turbo) Developing A CurriculUM (DACUM) process, which provides a systematic, methodical, extremely detailed approach to defining work done for a specific job. This process revealed 26 different "duty areas" and identified more than 170 different tasks, all of which require a specific combination of skills. In contrast, previous curricula had identified only about five required basic skills.
2. **Setting industry standards and establishing the specific competencies to be taught:** Industry standards were set based on the priorities established in the Delphi prioritization process that followed the DACUM. In this context, The Delphi method is a structured, iterative communication technique that relies on a panel of experts to identify priority skills.
3. **Curriculum development:** For a successful scale up and to ensure the curriculum would apply across many companies and diverse situations, AMTEC adopted two important rules: 1) the curriculum must include only those tasks and skills common to all industry partners; and 2) the curriculum must focus on tasks and skills required, not on how those tasks or skills are organized in any individual workplace. 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 these courses were broken down even further into small modules.
4. **Competency-based assessment:** 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.
5. **Credentials:** To date AMTEC's work has largely focused on identifying and assessing competencies. They are currently developing three credentials for Electrical, Mechanical, and Multi-Skilled Technicians, but this focus may change as they work with NAM to finalize the credentials. AMTEC also plans to work with ANSI for third-party validation.
6. **Instructional design and delivery:** The delivery of AMTEC curriculum has three key components: 1) small learning modules delivered online; 2) contextual learning environment (must occur in a setting that is as close to the actual work environment as possible); and 3) flexibility (i.e., flexible scheduling, blended learning opportunities, accelerated learning, and "testing out" of skill areas where students are already competent).
7. **Continuous improvement:** The process of continuous improvement of the standards and curriculum is a priority for AMTEC. However, since the curriculum was first rolled out in late 2012, continuous improvement processes have not yet been implemented.

Note: Although the core elements of quality are evident in the AMTEC model, the *user quality dimension* (particularly the take-up rate by employers) is yet to be demonstrated, since credentials have not yet been identified and awarded.

3. A national registry of credentials could be established and maintained. The registry would list credentials that meet predefined quality criteria, providing a way for workers to know whether a given credential is valid/valuable (i.e., developed in adherence with the quality standards outlined in this report). The registry would bring benefits for other players in the marketplace as well, allowing businesses, training providers, and workers to access information about the quality and market relevancy of different credentials. Effective practices could be shared and promoted, and the costs of duplicated credential development would be reduced. Currently there is no "one stop shopping" for listing of credentials and often each location has their own criteria or no criteria and provides (only for information) all known credentials with no assessment of value.

These kinds of quality assurance mechanisms would give workers and employers confidence that individual credentials have real meaning and value. This is essential for the development of a thriving competency-based credentials market. The following sections of the paper focus on how to grow that market, by engaging employers, workers, and educational institutions more fully.

Expanding Use of Competency-Based Credentials by Businesses

The meaningful engagement of business and industry is critical to the success of any credentialing effort. At the most basic level, a credential must be built around competencies and learning outcomes that are directly aligned with business needs. But for employers to believe that a credential has meaning—and thus be willing to use it—they have to be genuinely involved in *all parts* of the credentialing process.

Not surprisingly, many of the credentials that have successfully taken hold have been driven and developed by various configurations of employers, in direct response to pressing workforce needs. The trailblazers in this work have largely been industry associations, consortia, and partnerships that were initially focused on skill standards. Expanding the use and quality of credentials across the country will require much greater involvement by businesses. Strategies for cultivating that involvement are outlined below.

What Is Necessary to Increase the Uptake of Quality Credentials by Businesses?

Numerous competency identification and credentialing initiatives (such as under the National Skills Standards Board) have actively engaged industry upfront in identifying skills needs but have had challenges in getting industry to recognize credentials. More traditional postsecondary degrees (bachelors' and associates' degrees) have been used for many years as a hiring screening tool and a proxy for documenting that an applicant has the needed skills. For an expanded credentialing system to be effective, it is critical that employers view credentials as meaningful to their competitiveness and bottom line. Engaging employers upfront in identifying competencies is not enough – they must see value in the credentials for hiring purposes.

So how do we increase the use of credentials by employers? Documenting the return on investment (ROI) and making a business case for actually using credentials in hiring and employee development is key. Businesses need to know that the time and effort required in understanding, helping develop and using competency-based credentials will pay off in concrete ways. Some good preliminary work has been done in this area. For example, Georgia Work Ready[22] conducted an analysis with CJB Industries, a major employer in the state, which showed that turnover was more than cut in half after the company started using Work Ready credentials. The hiring process became more

efficient (with fewer applicants reviewed for each open position) and productivity was greatly increased. The total return on investment was calculated to be more than $1.5 million annually (See Attachment C).

This kind of information is a powerful motivator for businesses, but robust return on investment analyses are rare. Scaling up the use of competency-based credentials will require much more ROI work at the local, regional and national level. *All* the players in and supporters of a credentials market—including policymakers and philanthropists, business associations, sector partners and educational institutions—should be thinking about how to better document the return on investments made in developing and using high-quality competency-based credentials.

Benefits for Employers

Siemens, a global electronics and electrical engineering firm, has used a training approach developed in Germany to create an international skills certification program, in partnership with schools in several countries. Siemens reports several concrete benefits from its use of competency-based credentials, including:

Well-Trained, Work-Ready Technical Workers. The Siemens Mechatronic Systems Certification[23] emphasizes in-demand industrial skills, troubleshooting, and hands-on practice, providing employers with knowledgeable workers who are able to easily move into a variety of production, technician, and/or engineering roles.

Objective Certification of Workers' Technical Skills. The certifications provide an objective, industry-aligned assessment of mechanical, electrical, and digital technical skills, troubleshooting, and mechatronic systems thinking.

Cost Savings on Training and Education. Companies and industries can receive much-needed skilled technical workers while drawing on local education and training resources instead of always relying on private training companies.

What Is the Role of Different Stakeholders within Businesses?

Another theme that emerged in our interviews is that "business" is not a monolithic group of like individuals. Rather, the term encompasses numerous people playing very different roles within their companies. Key players include the CEO, HR Directors, and Supervisors, as well as the Subject Matter Experts who perform specific functions—all have varying input and influence on workforce decisions. Credentialing efforts need to involve all levels within participating firms. This is demonstrated in the following chart, which outlines the roles that different people can play in the credentialing process.

Position	Role in Developing and Using Credentials
CEOs	Understanding the "big picture" and long-term trends around business growth and labor needs Articulating return on investment at companywide level and motivating others to see value of credentialing work
HR Leaders	Knowing about specific vacancies, turnover, and training needs Benefitting from more efficient hiring processes and reduced turnover
Plant Managers	Understanding industry trends and competitiveness issues Knowing about specific skill-education-knowledge needs and the impact of technological advances on work processes (Subject Matter Experts)
Frontline Supervisors	Knowing about specific skill-education-knowledge needs and the impact of technological advances on work processes (Subject Matter Experts)
Frontline Workers	Describing the day-to-day work activities and skill needs of a particular position (Subject Matter Experts)
Industry Association Leaders	Bringing a broad perspective about what they are hearing from their members, such as industry trends and core skills shortages

It should also be noted that organized labor can be an important partner in credentialing efforts. Ensuring that union members have market-relevant skills is central to most unions' work, and there are a number of union-led partnerships that bring together labor and management to develop and implement competency-based programs. Examples include the United Auto Workers'[24] role in training and operating apprenticeship programs and SEIU Local 1199's healthcare industry training and upgrading fund[25].

What Is the Role of Industry Associations and Consortia?

National industry associations like NAM and consortia like the CEWD are in an excellent position to advance credentialing efforts—and have the industry credibility to make credentials portable across state lines. Specific models such as PNCECE, the NAM-endorsed Skills Certification System and the American Water Works competency model have shown that credentials can be useful and relevant across states and regions. Increasingly, the goal is to make them portable internationally as well. For instance, IREC uses the Institute for Sustainable Power Quality (ISPQ)[26] international framework to assess content, quality, and resources across a range of renewable energy, energy efficiency and weatherization training programs.

More research is needed to understand the factors that have enabled some industry associations and consortia to make progress on competency-based credentialing, while others have not. Our study suggests that one challenge is variation in local industry processes and skills requirements, as well as variation in the availability of educational institutions to partner with. This can make it difficult for a national organization to advance a credentialing effort. It is also true that many industry associations and consortia have simply focused on other issues—for example, tax laws or regulations affecting their industry. Groups that have zeroed in on workforce

The National Association of Manufacturers' Manufacturing Institute developed a system of stackable credentials that apply to different sectors in the manufacturing industry. The certifications "build on a foundation of basic academic and workplace requirements, followed by cross-cutting technical competencies and then more specialized, occupationally specific skills" and are "capped with professional and managerial certifications offered at the baccalaureate and graduate levels."

development have often done so because they recognized that serious labor shortages were coming (e.g., because a generation of workers were approaching retirement age).

The American Water Works Association and the **Water Environment Federation** teamed up with DOL's Employment and Training Division to address potential upcoming labor shortages (due to retiring employees) in the wastewater and municipal water industries. They created a water sector competency model, which both national organizations are helping apply at the local level, including customization to meet regional needs.

There are a number of things that industry associations and consortia can do to advance credentialing efforts for their member businesses:

- Collect and publicize data on skills shortages and the use of credentials in your industry (as NAM[27] and CompTIA[28] have done).
- Establish member working groups to identify skill standards. This is a good starting point for industry associations and consortia that want to tackle workforce issues.
- Develop industry-wide, portable, foundational credentials, which can then be customized at the local or regional level (for example, the American Water Works Association[29] and the Water Environment Federation[30] both have local chapter infrastructures that they are using to support regional customization of the national competency model).
- Join or collaborate with regional sector partnerships on credentialing efforts, including career pathway initiatives.
- Partner with community colleges to develop training and credentials.
- Document the return on investment for members using credentials.
- Promote credentials to members by developing case studies or testimonials of businesses in their industry that are using them successfully.

Industry associations and consortia are important vehicles for increasing the engagement of businesses in credentialing work. Indeed, some have made great strides in developing and marketing high-quality credentials. Associations and consortia that have not been involved may jump at the chance if an appropriate infrastructure is developed to support their efforts. We revisit this theme in the concluding section of the report.

What Is the Role of Sector Partnerships?

Regional sector partnerships are gaining prominence around the country as a central economic and workforce development strategy. They emerged in response to criticism that the U.S. training system was disconnected from the realities of the labor market—with training programs focused on skills that weren't necessarily in demand by local businesses. These partnerships explicitly focus on identifying the needs of employers within a given industry sector, and aligning regional training and education programs around those skills—improving the pool of labor available to businesses as well as the employment opportunities available to workers.[31]

Creating Credentials That Are *Portable*

- Several interviewees envision a system with foundational certificate(s) that are nationally portable, with specialty certificates and/or regionally relevant competencies built on top of this nationally recognized certificate.
- The representative from NAM stated that "portability" was the primary element in building a successful credentialing system.
- According to one interviewee, "While these processes need to be local, we don't need a bunch of very local credentials (or specialty credentials for every employer) – it's at least important to get past a single entity offering a credential. There needs to be a rigorous and transparent development process (e.g., sit for an exam)."
- National or regional credentials are important to facilitate the mobility of the worker. Individuals in the United States are highly mobile and will move often throughout their working life. The credential must be able to move with the worker. This standardization will enable employers to understand what credentials "mean."
- Postsecondary institutions and sector partnerships can work with—and leverage the credibility of—national business associations and consortia to develop credentials that are portable across their region and/or the nation.
- Strategies for enhancing portability must include **portability across several dimensions**: portability across employers, portability to higher-level occupations and credentials, portability across sectors, portability across regions/states, and international portability.

Given this focus, and the participation of industry, education/training providers and government agencies, these partnerships have great potential for advancing credentialing efforts. Yet our research suggests that, to date, few sector partnerships have stepped into the credentialing fray. This may be, in part, because many of these collaborations are relatively new. Moving forward, we see a number of opportunities for regional sector partnerships to become more involved in competency-based credentialing efforts:

- **Focusing on customization**, particularly with respect to the *regional customization* needed to make credentials relevant and useful in specific local labor markets. Whereas national industry associations and consortia may find it challenging to deal with local variation, sector partnerships are, by definition, regional or local in scope. Ideally, sector partnerships will collaborate with national industry associations, consortia, and other national certificate issuers to avoid "reinventing" the wheel with new credentials or creating credentials that won't be relevant in other parts of the country. Instead, these groups can work together to develop industry-wide, portable, foundational credentials, which can then be customized to meet regional industry needs—by adding specialty certificates and/or integrating regionally relevant competencies to national certificates.

- **Documenting return on investment**, or the business case, at the regional level, that identifies and articulates the value and return on investment to employers who use competency-based credentials. They should conduct a strong and aggressive outreach effort based on the ROI analysis and promote common terminology about the credentialing process that business partners can easily understand.

- **Engaging local educational institutions and training providers** in aligned credentialing processes that represent a new "way to do business" for community colleges and other training institutions. These strategies help ensure that education programs meet the needs of the region's industries and that graduates have access to viable career paths. Regional sector partnerships can help educational institutions and training providers be cognizant of what employers worry about:

  - *All Employers*—The economy, cost, profits, regulations, competitiveness (including global competition), competition for skilled labor, markets.
  - *Small Employers*—No/limited HR and/or multi-functional positions, the ability to compete for talent, limited profit margins, resources for training, entry into new markets and/or supply chain options.
  - *Big Employers*—Scale of workforce needs, layered management and HR, corporate or local office, supply chain management and market expansion.

- **Capitalizing on the skills and enthusiasm of a strong "neutral convener"** in the critical role of supporting the partnership, coordinating people and resources, and ensuring concrete results that are meaningful to business and industry. A strong convener can initiate a credentialing effort and keep it on track.

- **Leveraging multiple funding streams to support credentialing work**, including industry funds (as in Bonneville Power in Washington), grant funds (e.g., PNCECE, AMTEC), curriculum development funds, workforce investment funds, and more.

- **Working with other sector partnerships** from across the country to develop a platform for sharing (and providing feedback on) best practices, industry standards, curriculum, assessments, etc. Improved communication across these groups will help ensure transparency and portability and will speed up the adoption of effective credentialing practices.

Although the role of industry sector partnerships in credential development and use is still in its infancy, significant potential exists to catalyze the 1,000+ sector partnerships in the U.S. to participate in a burgeoning credentials market. These partnerships can help foster local consensus about the value of competency-based credentials and can work with national groups to develop credentials that are customizable and nationally portable.

Expanding Use of Competency-Based Credentials by Workers and Learners

For the credentials marketplace to thrive, workers and students must perceive credentials as useful. Is there a clear return on investment, in terms of employment and future wages, to justify the costs of tuition to obtain the credential? Do they help students access better jobs? Does the credential serve as an effective stepping stone to higher levels of education? Are there mechanisms that provide critical consumer information, allowing students to discern high-quality, industry-validated credentials from those with little or no value? These issues must be addressed in order to expand the use of credentials among workers and students.

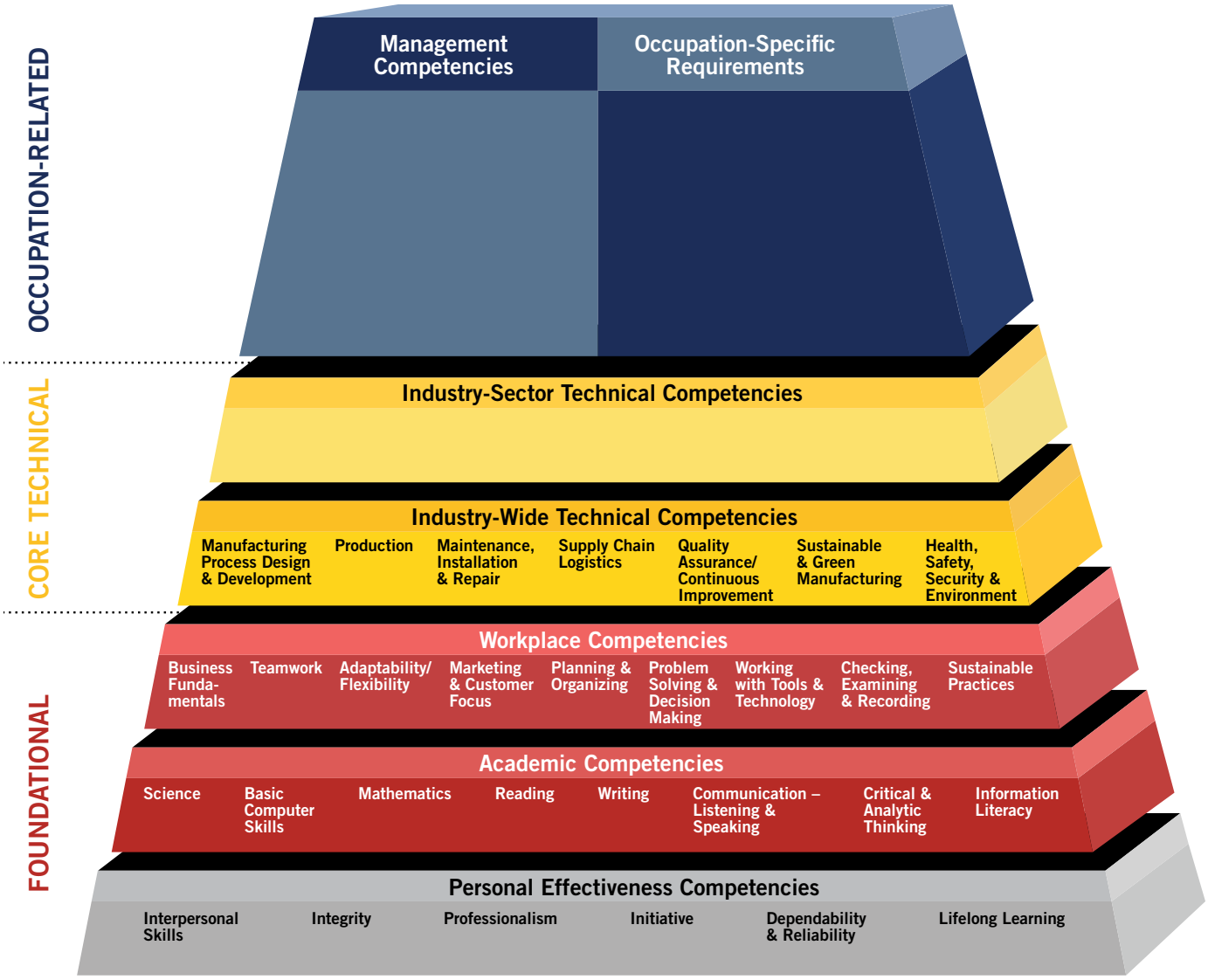
Showing the Link Between Credentials and Employment

Getting more workers to use competency-based credentials hinges, most fundamentally, on demonstrating that these credentials have value to employers. If workers know they will be more likely to be hired or promoted—and that they can access better-paying, higher-quality work—thanks to a credential, it is easy to see how the use of these credentials would grow. In IT, for example, employers have come to see certain credentials (like the A+ certification[32]) as essential. Workers know that these credentials are needed to access certain positions—positions that tend to be appealing because they pay relatively well. As a result, these credentials are highly sought after. Thus, in a way, the strategies outlined in the last section, aimed at increasing uptake by employers, are also important for expanding the use of competency-based credentials by workers.

Accelerating the Stackability and Bundling of Credentials to Support Career Pathways

As it stands, it is often difficult for workers and students to know what kind of training is needed for various positions within a given industry, let alone options for transferring skills across industry sectors. Workers need to be able to access information about how different credentials fit into larger career pathways. They need to know not only that a given course of study and accompanying credential have "face value" for employers, but also that they represents a step toward more advanced training and education and a viable long-term career.

Advanced Manufacturing Competency Model



OCCUPATION-RELATED

High-demand occupations are matched with critical industry certifications in such areas as machining, welding, fabrication, automation, fluid power, mechatronics, transportation/distribution, and logistics. At the top of the model are managerial and specialty occupations, including engineering.

CORE TECHNICAL

Core technical skills that impact the bottom line include: safety, quality and measurement, maintenance installation and repair, production, and sustainable manufacturing.

FOUNDATIONAL

Basic skills that cut across all sectors in manufacturing include:

- Workplace competencies: Do workers use critical thinking skills, work in teams, and have problem solving skills?
- Basic applied skills in reading, writing, math, and locating information: Can workers communicate effectively, follow key instructions, and read manuals?
- Personal effectiveness: Will prospective employees show up on time, be dependable, and demonstrate initiative?

Source: U.S. Department of Labor; National Association of Manufacturers Manufacturing Institute; Society of Manufacturing Engineers; and National Council for Advanced Manufacturing.

As noted above, several credentialing efforts – including USDOL, PNCECE, NAM (pictured below), and CEWD – have attempted to address these challenges by offering multi-tiered systems that assess and credential several levels of skills. These tiers have various labels, but generally include academic skills, personal and workplace readiness skills, and basic industry requirements, in addition to occupation-specific competencies. These credentialing approaches provide a good model for other nascent credentialing efforts.

We believe that accelerating the Stackability and bundling of credentials is essential to expand their use by workers. Steps in this direction include:

- **Adopting multi-tiered models that include foundational academic skills**, workplace readiness skills, industry-wide and sector-related technical requirements, and occupation-specific skills.
- **Working with regional employers to modify national industry credentials** to meet regional needs. National models such as NAM and CEWD offer a strong foundation for identifying the critical skill needs of industry. These models offer the "common core" competencies and skill standards shared by industry members, but do not generally represent all necessary competencies. Based on our interviews, we estimate that they reflect about 70-80 percent of the skills needed, while the remaining 20-30 percent vary at the regional or even company-specific level.
- **Supporting collaborative efforts along the K-12, adult basic education, and postsecondary educational continuum** to ensure that students and workers can "stack" valid credentials without having to repeat coursework and relearn competencies/skills. Building stackable competency models with the incorporation of credentialing can be a vehicle for linking secondary, postsecondary and industry-specific training—which is essential in pipeline and career pathway strategies.
- **Maximizing the use of prior learning and competency-based assessments**, as well as competency-based instruction (non-seat-time based) to accelerate the attainment of stackable credentials.
- **Mapping and clearly articulating career pathways** (to include both education and occupational pathways), so that students and workers can easily move in and out of the educational system and stack credentials as needed. Educational institutions and nonprofits that advise students about their options and help them navigate career pathways provide a critical service here.
- **Ensuring credentials and pathways are accessible.** Creating clear career pathways helps ensure that workers understand their educational options and can see which job opportunities will open up with various courses of study and credentials. But credentials *also need to be accessible in terms of money, time, and basic skills requirements.* Training programs that are

extremely expensive or have inflexible schedules can be out of reach for many workers. Some students may need opportunities to boost basic skills before tackling more advanced content. Carefully linking postsecondary training with secondary and adult education programs is part of what's needed to make the credentialing market more accessible and effective for workers and students.

Integrating Employability Skills into Competency-Based Credentials

As noted above, technical skills requirements in various industries are rapidly changing, and employers continue to stress the importance of *basic employability skills*, such as the ability to adapt, think critically, innovate, communicate effectively, and identify and solve problems. Thus, it is critical for workers to be able to develop and demonstrate these skills. Unfortunately, these cross-functional skills can easily get lost in the discussion of market-relevant credentials, which are most often perceived as focused on occupational and technical competencies. Basic employability skills must be injected back into that discussion and must be seen as a core component of any credentialing initiative.

There are a limited number of credentials that measure these kinds of skills (ACT's WorkKeys® system, including the NCRC-Plus, is one example). This is an area that is ripe for further investment by public and private funders. Work must be done to develop systematic and replicable models to teach and document complex employability skills, such as innovative and critical thinking. This will help expand credentials' value, from both the employer and the worker perspective.

Expanding Use by Educators

More and more educational institutions are thinking about how to directly align their programs with current and future labor market needs. There are several promising efforts that suggest routes by which educators and employers can align around competency-based credentials. For instance, Missouri University (MU) used the CEWD/DOL Energy Generation, Transmission and Distribution Competency Model to refresh its curricula[33]. MU and its partner colleges cross-checked individual courses against all the competencies in the model. The effort yielded a new undergraduate minor in Energy Engineering at MU's College of Engineering, new and updated courses, and a clearer career pathway for learners (made possible by articulation agreements among the educational partners).

Other college-led credentialing efforts include the Kentucky Community and Technical College System's Learn on Demand[34] online competency-based learning option and similar approaches being tried at Southern New Hampshire University[35], Western Governors University[36] and the University of Wisconsin[37]. Recently, the American Association of Community Colleges' 21st Century Commission[38] called for expanding the use of competency-based credentials—a move that demonstrates the momentum around credentialing in higher education circles.

Indeed, competency-based credentials fit well with a core and growing part of many community colleges' mission/business—to meet local employer needs and effectively serve adult learners. Some community colleges already offer training, proctor certification tests, and issue a substantial number of certificates at the sub-BA level. Yet relatively few schools are actively working with business associations or regional sector partnerships to advance the broad-scale use of high-quality competency-based credentials.

This is unfortunate, because these credentials represent an important opportunity for educational institutions. Credentials can increase the employability of students who attain them – in both the short and long-term. They also boost the confidence of employers, workers and students in the relevance of company-sponsored education and customized training efforts by offering a more precise way to articulate what the worker knows and can do. Finally, community colleges are increasingly being held accountable for results, including students' learning and employment gains. Schools that adopt market-relevant competency-based credentials have a tool for improving their performance and demonstrating their value to funders, students and communities.

How can more educational institutions begin to take advantage of these opportunities? Our research suggests a number of possibilities:

- **Work with existing or new sector partnerships** to identify critical occupations and their related competencies, and to develop the aligned components of a quality credentialing process (e.g., standards, competency-based curriculum, instructional delivery, assessments, credentials, and continuous improvement).

- **Find multiple ways to engage employers as partners** by working with local employers on everything from needs assessments, curriculum design and internships, to the issuance and validation of credentials and hiring of new workers. Help local firms/industries develop common language and encourage them to use relevant credentials. If possible, accelerate the time it takes to complete coursework and obtain a credential to meet employer demand. This kind of collaboration and flexibility can help make community college a valuable partner to the business community. Develop a consistent, detailed process for profiling jobs and developing related standards and competencies.

- **Use credentials to match students' needs more effectively** in multiple ways by meeting them where they are. Develop assessments and processes that allow the recognition of competencies students acquired in non-collegiate and work-based experiences. Maximize opportunities for students in what are now non-credit course to obtain market-relevant credentials. Incorporate credentials and career pathway options as you work to help students navigate their educational choices. Adopt credentials that are stackable, both internally and externally. Break curriculum into smaller modules and identify and use credentials that reflect learning in each module.

- **Provide all community college students with opportunities for real-world applied learning experiences**, such as internships and co-op programs. Quality Work-Based Learning experiences give students opportunities to transform and transfer the learning they receive in the classroom to what they will actually do in the workplace. They have the opportunity to solve real work problems, reflect more deeply on their learning, receive authentic feedback from experienced workers ("mentors"), take action, gain experience, and better understand the theory about the practice—knowing why, knowing what, and reflecting.

- **Focus on credentials-related outcomes** by setting and measuring goals for credential attainment and employment. Integrating competency-based credentialing initiatives into institutional strategic plans is a way to get started and develop related goals and metrics. Colleges could map credentials that have met specific criteria (created by a national center) to all appropriate academic programs of study to determine the percent of students choosing to obtain a credential, success rates of obtaining the credential and if the credentials appear to facilitate employment.

Colleges that expand their use of competency-based credentials are likely to see significant dividends. Strengthening relationships with local employers, building more integrated and effective education and workforce development systems and improving outcomes for students are just a few of the potential benefits. As we explore in the concluding section of this paper, educational institutions have the opportunity to work with businesses, funders and policymakers—at local, state and national levels—to significantly increase the quality and scale of competency-based credentials.

How Siemens Approached the Core Elements of Quality

Siemens developed their international mechatronics certification focusing on three key areas of quality: curriculum development, instructor training, and a certification exam.

- To inform curriculum development, the Siemens Technical Academy in Berlin consulted with Siemens business units, Siemens customers, and an international group of workforce development professionals from the U.S., Germany, and Asia to outline the needed skill sets for three jobs— mechanic systems operator, mechatronic systems technician, and mechatronics engineer. However, they left enough 'wiggle' room for customization to meet local/regional labor market needs. From this point, Siemens identified the core Mechatronic competency areas (skills, technical awareness, and theory) to meet the requirements outlines in the three job profiles.
- Siemens believes that instructor certification is key to the certification process because the Systems Approach teaching philosophy and methodologies they use require teachers to teach in a new way. The teaching philosophy focuses on the early introduction of complete operational systems to students, which are then used to teach both practical and theoretical concepts, allowing for the integration of hands-on learning and practical technical trouble-shooting/problem-solving into classroom instruction. Siemens designed its Instructor Certification courses to provide professional development to instructors, introduce the System Approach methodologies, and review Mechatronics core content areas so that instructors were prepared to return to their campus and implement these "very German" best practices and ideas into their classroom.
- Siemens developed an objective industry aligned certification exam that tests and validates students' competencies related to mechatronics and system troubleshooting. They report that partner schools "find that a variety of local employers around the world value the objective validation of the students' skills offered by the Siemens Mechatronic Systems Certification program. Since most training and hiring is 'local', our goal is to help our partners improve their local workforce and focus by implementing SMSCP in a way that aligns to their local industry needs."

Summary: Growing the Market for Competency-Based Credentials

Across the country, among leaders in business, education, philanthropy and policy circles, there is strong interest in expanding the use of competency-based credentials. Unfortunately, as it now stands, the market for such credentials is messy, chaotic and not fully formed. We believe there are several key levers that could be used to nurture this market —places where effort could be exerted to bring the use of high-quality competency-based credentials to much greater scale. As described throughout this paper, national industry associations and consortia, regional sector partnerships and educational institutions all have a role to play. And workers and students need to perceive credentials as valuable. But for the market to flourish, there also needs to be a scaffolding or infrastructure, supported by public and private funders (and with active engagement of industry, education and external validators), to address the following core issues:

1. **Shared Language**. Common, consistently used definitions of key terms are needed to make competency-based credentials easier to understand and use.
2. **Credential Quality Assurance.** Stakeholders must be confident about the rigor behind credential standards and their fit with employer needs.
3. **Consumer Information.** Market participants need to be able to understand clearly the meaning of various credentials and be able to use them in multiple labor markets easily.
4. **Policy Change.** Federal, state and institutional policy changes are needed to support the expansion of competency-based programs and credentials.
5. **Alignment of Efforts.** There needs to be better communication and coordination among the dozens of competency-based credentialing efforts being undertaken by businesses, regional partnerships and educational institutions.

Extensive work is needed in each of these areas to develop a quality, fully-functioning credentials market. We believe some of this work should occur at the federal level. Thus, we are advocating for:

- **The creation of an Interagency Credentialing Steering Committee.** The purpose of this Committee would be to leverage the significant assets and influence of the federal government to update and streamline federal credential-related policies and practices. This body could build on the

momentum of current efforts and lead initiatives in the five key areas outlined above. First steps could include an inventory of credentialing-related initiatives across agencies, documenting overall expenditures with an eye toward achieving efficiencies and better leveraging of resources, collecting and sharing lessons from existing agency efforts, and issuing an annual report on progress being made.

- **Establishment of a public-private sector Strengthening Skills and Credentials Council**. This Council would bring together key public and private stakeholders to develop a comprehensive framework for a quality credentialing system. This partnership would include industry and professional organizations, unions, foundations, education and workforce development organizations, credentialing bodies, state government representatives and multiple federal agencies from the *Interagency Credentialing Steering Committee.* We believe ANSI could work effectively with federal policymakers to launch such a body, which could focus on developing quality assurance criteria and strategies to meet the skill needs of the 21st century economy.

While these federal initiatives could go a long way toward building an effective credentialing system and bringing the use of credentials to scale, the credentials marketplace need not wait for federal action. Various other strategies—including both "bottom-up" (i.e., regional and institutional) and "top-down" (i.e., national- and state-level) approaches—can be leveraged to expand the quality and use of competency-based credentials:

Regional- and institutional-level (bottom-up) strategies:

- Develop regional and institutional incentives and metrics to encourage the use of quality credentials. This may include:
  - Program development guidelines to help colleges build curricula that meet competency-based and industry standards.
  - Metrics that focus on industry-driven credential attainment at community colleges.
  - Criteria for validating credentials that are, at a minimum, similar to ANSI's certificate process.
- Reduce institutional barriers within colleges between credit- and noncredit-bearing education.
- Leverage existing national certificate(s) or credentialing systems as the foundation upon which to add specialty certificates and/or regionally relevant competencies.
- Link data systems to provide a more comprehensive picture of student learning outcomes and return on investment for businesses and educational institutions.

State- and national-level (top-down) strategies:

- Develop state-level incentives and metrics to encourage the development and use of quality competency-based credentials.
- Consider adopting a "Center of Excellence"[39] model (as in Washington, Wisconsin and AMTEC) that focuses on the workforce needs of a targeted industry across multiple regions, the state, or multiple states.
- Identify effective "levers of change" at the state level that can move credentialing efforts forward. This could include such partners/ supporters as: the statewide community college system, the state workforce board, and state-level industry associations and consortia.
- Identify and remove existing federal and state higher education policy barriers. For example, in a recent report, CAEL noted that a newly issued federal definition of the "credit hour" may be interpreted as meaning that seat time is the primary consideration in determining whether a postsecondary program qualifies for federal financial aid. This definition could be revised to validate competency-based programs.[40]
- Include credentialing incentives in national grant opportunities.
- Develop a national registry of competency-based credentials that meet predefined quality criteria (this could provide a "carrot" for educational institutions to get more involved in credentialing efforts).
- Identify effective curriculum and credential development methodologies and work toward consensus about the essential components of a quality credentialing system.
- Develop standardized terminology, metrics and data collection.
- Create a national, competency-based framework for U.S. postsecondary education that includes certificate-level workforce education and training.
- Establish a communications and advocacy campaign about the critical importance of high-quality competency-based credentials.

Final Thoughts

Experts like Louis Soares from the Center for American Progress[41] and Salman Khan, founder of Khan Academy,[42] have pointed to the tremendous opportunities that technology provides for making competency-based education "the way to a future where education can be high-quality and personalized, yet so affordable that it's accessible to millions of additional learners."[43] What will be needed to make this vision a reality is something akin to the "collective impact" movement that has emerged in various

American cities over the last decade. As with collective impact efforts, a functioning credentials market requires the active participation of a range of players who may not be accustomed to working together—including businesses, nonprofit and educational institutions, workers and students, government agencies and philanthropy. And, as with collective impact, building a healthy credentials market depends on a centralized infrastructure—what the leaders in collective impact work have described as a "backbone organization," with "dedicated staff" and "a structured process that leads to a common agenda, shared measurement, continuous communication and mutually reinforcing activities among all participants."[44]

In the competency-based credentials market, a backbone organization could help develop shared definitions and agreement about the elements of a quality credentialing process; it could spearhead the creation of a credentials registry; it could identify and advocate for needed policy changes; it could encourage—and share information gleaned from—ROI analyses; and it could help stakeholders work together to tackle critically important portability and access issues.

Of course, building this kind of infrastructure is important but not sufficient for scaling up the use and quality of competency-based credentials. As outlined above, business associations, regional sector partnerships, educational institutions, and external validators all have critical roles to play, as do public and private funders—who can create incentives for these other actors to become more deeply engaged in credentialing work. When they do, competency-based credentialing can become a common language that helps businesses, educators, and workers and students navigate increasingly complex and volatile labor markets with improved speed and accuracy.

Appendix A: Interview Participants and Case Study Examples

Interviewees

- Michael Brown, Skills Net
- Emily DeRocco, (formerly) the Manufacturing Institute - National Association of Manufacturers (NAM)
- Barbara Hins-Turner , Centralia College Center – Pacific Northwest Center of Excellence for Clean Energy
- Volker Rein, Federal Institute for Vocational Education and Training (BIBB) in Germany
- Roy Swift, American National Standards Institute (ANSI)
- Sarah White, Center on Wisconsin Strategy (COWS)

Case Studies

- American Water Works Association and the Water Environment Federation Competency Model
- Automotive Manufacturing Technical Education Collaborative (AMTEC)
- Building Performance Institute
- The Center for Energy Workforce Development (CEWD) - Get Into Energy (GIE) Career Pathways Model
- DACUM (Developing A CUrriculuM) and Turbo DACUM processes
- Harper College Partnership
- The Interstate Renewable Energy Council's (IREC) Job Task Analyses
- Missouri University
- National Association of Manufacturers (NAM) - Advanced Manufacturing Competency Model and NAM-Endorsed Manufacturing Skills Certification System
- Northeast Pennsylvania Logistics and Transportation Industry Partnership
- Pacific Northwest Center of Excellence for Clean Energy (PNCECE) – A Centralia College Partnership
- U.S. Department of Labor Competency Model Clearinghouse

Appendix B:
Participants in Dialogue on Competency-Based Credentials
October 23, 2012, Long Beach, CA

- Marc Anderberg, SkillsNet
- Keith Bird, Corporation for a Skilled Workforce
- Stan Chase, AMTEC
- Vickie Choitz, CLASP
- Stacia Edwards, Battelle
- Marcie Foster, CLASP
- Evelyn Ganzglass, CLASP
- Benjamin Goldstein, U.S. Dept. of Energy
- Rachel Gragg, National Skills Coalition
- Angela Hanks, National Skills Coalition
- Becky Klein-Collins, CAEL
- Jamie Krause, Pacific NW Center of Excellence for Clean Energy, Centralia College, WA
- Vijay Krishna, ANSI
- Nancy Laprade, Corporation for a Skilled Workforce
- Alissa Levine, Center for Energy Workforce Development (CEWD), CUNY, Kingsborough Community College
- Taryn MacFarlane, Corporation for a Skilled Workforce
- Darlene Miller, NCWE
- Rebecca Nickoli, Ivy Tech
- Nan Poppe, formerly, Portland Community College and Completion By Design
- Audrey Theis, NAM/ Manufacturing Institute
- Jane Weissman, Interstate Renewable Energy Council (IREC)
- Sarah White, Center on Wisconsin Strategy (COWS)
- David Wilcox, Global Skills X-Change (GSX)
- Joan Wills, Institute for Educational Leadership

Attachment C: Georgia Work Ready Return on Investment (ROI) Analysis

Work Ready Tools have been an integral part of our hiring process over the last three years. They aid in identifying qualified workers for our profiled jobs and have helped in reducing turnover during this period from 20% down to less than 10% today. More importantly, it has allowed us to identify the people with the right skills allowing us to grow by more than 50% in a down economy. Without this important tool it would have been difficult to determine the right people who could perform at this level.

R. Clinton Beeland, Jr., President, CJB Industries, Inc. Valdosta, GA

CJB Industries, Valdosta, Georgia

- Number of employees in 2008: 36
- Number of employees in 2011: 73
- CJB requires Work Ready Certificates for those positions that they have profiled
- CJB has profiled seven (7) positions representing 60 jobs
- Began using Work Ready tools prior to October 2008

Reduced Turnover and More Efficient Hiring

- Reduced turnover rate from 19% in 2008 to 7% in 2011
- 30:1 -- Ratio of applicants processed to each position filled in 2008
- 15:1 -- Ratio of applicants processed to each position filled in 2011
- Estimated savings at $6,000 per new hire for hiring and training expenses =
- *$48,000 annually plus $1155 saved in promotion process*

Waste/Efficiency

- Waste rate reduced from .27% in 2008 to .09% in 2011
- Estimated savings = $21,555 annually
- Efficiency/productivity rate increased from 70% in 2008 to 78% in 2011
- Estimated savings = $272,268 annually

Hiring/Growth

- CJB ***doubled*** their workforce from 2008 to 2011, even in a down economy, and believes that using Work Ready tools was an important ingredient to this success
  - Added 37 new positions ranging in salary from $31,096 to $45,640
    - Added payroll of $1.29+ million dollars annually into regional economy (At a 22% tax rate = $280,000+ annually in tax revenue)

Total ROI = $1.58+ Million Annually = 33:1 Ratio

- Total return = $1.63+ million annually
- Georgia's investment in 7 profiles ($14,000), 66 employee assessments ($3696), and 555 pipeline (new worker) assessments ($31,080) = $48,776
- CJB's investment in subject matter experts (SMEs) for profiles = $800+ (40 hours)
- **ROI ratio excluding new salary growth figures, but including tax revenue = 12:1**
- **ROI ratio excluding new salary figures and new tax revenue = 7:1**

Endnotes

1. Some industries are experimenting with digital badges to confirm particular competencies. See, for example, Kevin Carey, "A Future Full of Badges," *The Chronicle of Higher Education*, April 8, 2012. Available at: http://chronicle.com/article/A-Future-Full-of-Badges/131455
2. For more information on CompTIA's A+ certification, visit http://certification.comptia.org/getCertified/certifications/a.aspx.
3. For more information on NAM's Manufacturing Skills Certification System, visit http://www.themanufacturinginstitute.org/Skills-Certification/Skills-Certification.aspx
4. For more information on CEWD's strategies and goals, visit http://www.cewd.org/strategies.asp
5. For more information on IREC's credentialing programs, visit http://www.irecusa.org/credentialing/
6. For more information on the Northeast Pennsylvania Logistics and Transportation Industry Partnership, visit http://nepapeopleonthemove.org/
7. For more information on Harper College, visit http://goforward.harpercollege.edu/
8. For more details on the Building Performance Institute's certifications, visit http://www.bpi.org/what.aspx
9. For more information on the Pacific Northwest Center for Excellence on Clean Energy, visit http://cleanenergyexcellence.org/
10. For more information on the American Water Works Association, visit http://www.awwa.org/
11. For more information on the Water Environment Federation, visit http://www.wef.org/onlineeducation/
12. For more information on the European Qualifications Framework, visit http://ec.europa.eu/eqf/home_en.htm.
13. The guidance letter located at http://wdr.doleta.gov/directives/attach/TEGL15-10.pdf contains encouragement of stackable credentials on page 11. Section 5 of the Credential Reference Guide includes current models of industry-recognized stackable credentials.
14. For more information on the Center for Energy Workforce Development's work with competency identification and certification, visit CEWD's Energy Industry Curriculum Center at http://www.cewd.org/curriculum/index.php
15. Career Cluster information and plans of study are available at http://www.careertech.org/career-clusters/glance/clusters-occupations.html
16. For more information on ACT's National Career Readiness Certificate and NCRC Plus, visit http://www.act.org/certificate/about.html
17. For more information on the Automotive Manufacturing Technical Education Collaborative, visit http://autoworkforce.org/
18. For more on Mozilla's Open Badges initiative in collaboration with MacArthur Foundation and HASTAC, see http://openbadges.org
19. Dimensions of quality modified from quality dimensions work done by Dave Wilcox, President, Global Skills X-Change.
20. For more on the American National Standards Institute's *Essential Requirements: Due process for requirements for American National Standards*, visit http://publicaa.ansi.org/sites/apdl/Documents/Standards%20Activities/American%20National%20Standards/Procedures,%20Guides,%20and%20Forms/2013_ANSI_Essential_Requirements.pdf
21. For more information on accreditation in the United States, visit http://www.ed.gov/admins/finaid/accred/index.html
22. For more information on the Georgia Work Ready initiative, visit http://workforce.georgia.gov/what-georgia-work-ready
23. For more information on Siemens' efforts to develop the skills of its mechatronics workforce, visit http://www.siemens-certifications.com
24. For one example of the United Auto Workers' education and apprenticeship efforts, see the UAW's joint apprenticeship program with Ford at http://uawford.org/apprentice
25. For more on the New England Health Care Employees Union (Local 1199)'s Training and Upgrading Fund, visit http://1199trainingfund.org
26. To read the full text of the ISPQ International Standard 01022, visit http://www.ispglobal.org/wp-content/uploads/2010/04/ISPQInternationalStandard_01022_1-3.pdf
27. To read NAM's Boiling Point? The Skills Gap in US Manufacturing (2011), visit http://www.nam.org/~/media/A07730B2A798437D98501E798C2E13AA.ashx

28. To read CompTIA's State of the IT Skills Gap report (February 2012), visit http://www.wired.com/wiredenterprise/wp-content/uploads/2012/03/Report_-_CompTIA_IT_Skills_Gap_study_-_Full_Report.sflb_.pdf
29. For a list of local American Water Works Association sections, visit http://www.awwa.org/membership/sections-your-local-awwa/local-sections.aspx
30. For a list of local Water Environment Federation, visit http://www.wef.org/Members/page.aspx?id=159
31. Lindsey Woolsey and Garrett Groves, *State Sector Strategies Coming of Age: Implications for State Workforce Policymakers*. National Governors Association, Corporation for a Skilled Workforce & National Skills Coalition, February 2013. Available at: http://www.nga.org/files/live/sites/NGA/files/pdf/2013/1301NGASSSReport.pdf
32. For additional examples from CompTIA of IT career pathways and credentials, visit http://certification.comptia.org/ExploreCareers/careerpaths/career_roadmap.aspx
33. For a summary of Missouri University's use of energy competency models to transform curriculum, visit http://www.careeronestop.org/competencymodel/info_documents/MU-CaseSummary.pdf
34. For more information on Kentucky Community & Technical College System's Learn on Demand program, visit http://learnondemand.kctcs.edu
35. For more information on Southern New Hampshire University's approach, visit http://www.snhu.edu
36. For more information on Western Governors University's approach, visit http://www.wgu.edu
37. For more information on the University of Wisconsin System's eCampus, visit http://ecampus.wisconsin.edu
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