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# **Building an Expanded Public-Private Data Infrastructure for the Credentialing Marketplace**

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Federal and state governments historically have played a major role in providing free and widely available information on college degrees and certificates, certifications, licenses, and other types of credentials to improve the functioning of labor markets in the United States. In more recent years, the government also has provided consumer information to students and workers so they can make more informed decisions about investments in credentials. However, the credentialing marketplace is now experiencing significant changes in the demand side (credentials employers seek) and the supply side (credentials available through educational institutions and other credentialing organizations). These changes are creating a growing need for better consumer information and decision-making tools—a need that is now pushing government labor market information (LMI) systems to their limits. At the same time, recent advances in information technology and the rise of new private-sector LMI providers have raised questions about the role of public- and private-sector players in providing labor market information in the United States.

As a result, we are now at a critical crossroads in deciding the future role of government in providing labor market information for the credentialing marketplace. Should government expand its data systems and guidance tools to address new information needs in the changing credentialing marketplace and move into the roles now played by private-sector providers? Or, should government policy move in a different direction and explore how to build an expanded public-private data

infrastructure that can be used by both government and private-sector providers?

This chapter explores the second option and its implications for government policy. It delves into the rationale for an expanded public-private data infrastructure that is designed to address changes in the credentialing marketplace and to leverage recent advances in information technology and related private-sector innovations. This paper proposes a new role for government in developing a public-private data infrastructure that can support an “open applications marketplace” that serves employers, students, and workers, as well as education, training, and credentialing service providers.

## CHANGING CREDENTIALING MARKETPLACE

Major demand-side and supply-side changes in national, state, and regional credentialing markets, along with new federal and state government policies, are exposing the limitations of the government data infrastructure that currently is used by government LMI systems.

Rapid technological and economic changes in the global innovation-based economy are transforming employer business models, work processes, and related job structures (U.S. Chamber of Commerce Foundation 2017b). The demand for postsecondary education and training is increasing (Carnevale, Smith, and Strohl 2013). At the same time, rapid and continuous skill-set disruptions are reducing the shelf life of worker skill sets (World Economic Forum 2016). These changes will likely drive greater need for continuous learning and credentialing, including more advanced degrees, certificates, certifications, and non-traditional microcredentials that address more specific skill sets.

As described by Cappelli (1999), these economic changes are exposing all major functions of businesses and employees at all levels to market pressures. Employers are increasingly engaging more open talent networks for getting work done. Many employers are outsourcing major business functions and experimenting with new types of employment relationships, including the use of independent contractors—what some have termed the “gig economy.” Many of these new employment relationships are developing at the margins or even outside current gov-

ernment regulatory policies and employment reporting systems, making it more difficult to capture information about employment trends. These changing relationships are pushing workers to take more responsibility for making their own career-related investment decisions throughout their working lives.

Demand-side changes will likely raise the stakes for employers, students, and workers in investing in skills and credentials. On the one hand, there will be growing investment opportunities carrying the promise of higher returns for the right investment decisions. On the other, there will be significant downside risks because investors will be placing multiple uncertain bets throughout their working lives, with shorter windows for achieving returns.

On the supply side, education, training, and credentialing organizations such as universities, colleges, and certification bodies are offering more options for students and workers engaged in lifelong learning and credentialing. This large and diverse credentialing marketplace is reflected in the recent inventory of credentials in the United States by Credential Engine (2018).<sup>1</sup> Many of these credentialing options, such as noncredit certificates and industry and professional certifications, are designed to fill gaps between rapidly changing employer hiring needs and the skills of already credentialed workers. In addition, many industry and professional organizations are encouraging higher-level and more specialized licensing requirements, such as health-care professional specializations. Some of these options go well beyond traditional government policy and regulatory boundaries and are not captured in government data systems. Finally, federal and state governments are launching new career and technical education and workforce initiatives that promote industry certifications, apprenticeship credentials, and other types of “industry recognized” credentials. These government initiatives also seek to connect all types of credentials to build better career and education pathways.

These supply-side changes and government initiatives provide growing opportunities to invest in skills and credentialing, but they also contribute to the growing uncertainty and downside risk for students and workers as they decide which education and credentialing options to pursue. Employers may also have difficulty differentiating among credentials as they make investment and hiring decisions.

The United States can be considered a national common market made up of local economic regions (e.g., metropolitan regional economies) that compete in different ways in the global economy (Barnes and Ledebur 1997). These demand-side and supply-side changes, as well as government initiatives, therefore play out differently throughout state and regional labor markets. Major metropolitan areas are competing with other major metro areas for recognition as global centers. Metro and rural regions are transitioning from manufacturing centers to play other roles in the global economy. Similar transformations are happening in rural regions. In recent years, major differences in labor market dynamics have emerged across these metropolitan regional economies (Moretti 2012). As a result, the demand for and return on credentials and skills vary widely across these regional economies. This further complicates the investment decisions of employers, students, and workers, who now must make decisions based on regional labor markets. It also puts more pressures on universities, colleges, and other education, training, and credentialing providers to address skills and credentialing gaps within and across these regional labor markets.

These demand-side and supply-side changes, along with new government initiatives, will create the need for real-time information at a more granular and regional level. These changing information needs likely will push the limits of the traditional public data infrastructure used by government labor market information systems. This is especially true for government systems providing consumer information to students and workers about the potential rewards and risks of pursuing the full range of credentials. To better understand these limitations, the following sections explore the scope and foundations of traditional government systems, as well as innovations among private-sector data providers, including those with implications for building a new public-private data infrastructure in the United States.

## **OVERVIEW OF GOVERNMENT LABOR MARKET INFORMATION SYSTEMS**

Government LMI systems have evolved over the years to address changes in government policy and labor markets. Federal statistical

systems have historically focused on providing core economic indicators (e.g., unemployment rates) for macroeconomic policymakers and market analysts (Reamer 2015). Federal and state LMI systems traditionally have been designed to support higher education and workforce planning, program approval, and funding allocations. Through these traditional functions, government systems capture and project information on industries and occupations. These systems also generate high-level occupational demand and supply reports based on occupational projections, as well as federal and state data on graduates of government-funded and regulated postsecondary degree and certificate programs. In addition, they capture high-level summary information on occupational tasks, skills, and requirements for education and credentialing (e.g., O\*NET). In recent years, the government has used these systems to provide career and education guidance and consumer information to students and workers to enable them to make better investment decisions in their education and training.

On the demand side, government LMI systems draw on employer data from administrative data systems (e.g., federal and state payroll reporting systems). These data are supplemented with employer surveys and other primary data collection strategies that capture occupational staffing patterns, compensation, and occupational profiles. On the supply side, LMI systems capture data from federal and state postsecondary education reporting systems that mainly cover government-funded and -regulated education and credentialing organizations such as public universities and colleges and federal workforce system providers. For example, new federal and state government individual-level longitudinal data systems provide credential attainment rates and employment rates and earnings of those completing credentials from government-funded and -regulated programs. These longitudinal data systems use administrative data from various federal and state sources, and they draw on employment and earnings data from federal and state employer payroll reporting systems (e.g., unemployment insurance wage records). Government LMI systems also have special data collection efforts to fill information gaps, such as recent efforts to capture data on industry and professional certifications.

## PRIVATE SECTOR INNOVATIONS AND LIMITATIONS OF GOVERNMENT SYSTEMS

Leading innovations among private-sector data providers go beyond what government systems have done to address changes in credentialing markets. On the demand side, real-time LMI providers capture and compile online job-posting data from thousands of job boards and websites daily. They use this “real-time LMI” to analyze changing employer hiring requirements, including expected skills and credential requirements. Many of these providers combine government, real-time LMI, and other data sources to provide more comprehensive LMI services. These providers include Burning Glass, Emsi, Geographic Solutions, and Monster.

The U.S. Chamber of Commerce Foundation is establishing a job registry service to build on its Talent Pipeline Management (TPM) initiative and improve employer signaling of changing skill and credentialing requirements (U.S. Chamber of Commerce Foundation 2017a). This job registry service will assist employers and their human resources (HR) technology partners in developing more accurate and comparable job descriptions with competency and credentialing requirements, and to distribute this data through multiple talent-sourcing channels. The registry service can be used by real-time LMI providers and by government LMI systems. It will build on the work of leading global standardization organizations that have developed schemas and standards for online job postings and job data in HR vendor systems (e.g., recruiting and applicant-tracking systems). These include job-related schemas from Schema.org and related standards from the HR Open Standards Consortium.<sup>2</sup> The job registry also will build on leading HR technology advances that promote vendor system interoperability.

On the supply side, Credential Engine is a new nonprofit with a mission to improve transparency in the credentialing marketplace. The organization is pioneering a new approach to gather comparable data on a range of credentials beyond the reach of existing government data systems, such as industry and professional certifications and noncredit certificates.<sup>3</sup> Credential Engine also is developing schemas and standards for defining the major descriptors for credentials and credentialing organizations referred to as the Credential Transparency Descrip-

tion Language (CTDL). These descriptors can be applied to degrees, certificates, certifications, licenses, apprenticeship credentials, badges, microcredentials, and any future credential type offered by public or private credentialing organizations. Credential Engine is developing definitions and vocabularies for these credential descriptors that build on well-established schemas from Schema.org for use by major search engines. Credential Engine descriptors also include important information on credentials not normally found in government data systems, such as competencies, assessments, and quality assurance. In addition, Credential Engine provides guidelines to credentialing organizations on how to publish comparable information about their credentials on the web and on a credential registry—a repository for credential information designed to support an open applications marketplace.

There are also supply-side innovations that allow students and workers to manage, store, publish, and distribute information about their competencies, credentials, and work experience. Private companies such as LinkedIn provide social media platforms for publishing professional profiles and making employer and professional connections. Other companies offer credentialing platforms that can manage and transmit more comprehensive student records, as well as more detailed portfolios and expanded résumés. Some companies also are exploring the use of distributed ledger (e.g., blockchain) technologies to provide secure and verifiable records of transactions. Still others, such as Glassdoor and PayScale, help students and workers better understand employer career opportunities and navigate the job market. These innovations demonstrate how student and worker platforms and data vaults can provide individuals with new services, allowing them to make better investment decisions in skills and credentialing.

As discussed earlier, national and state individual-level longitudinal data systems provide information on the labor market value of credentials, at least for those financed and regulated by government (e.g., public university and college degrees and certificates). The Manufacturing Institute, the National Student Clearinghouse, and the U.S. Census Bureau are exploring how to match a more comprehensive set of student and worker education and credentialing records with employment and earnings information. This would provide data on the labor market outcomes of all types of credentials, including industry and professional certifications and noncredit education certificates. The National

Student Clearinghouse collects and manages individual-level data on the vast majority of credential holders with postsecondary degrees from universities and colleges. The U.S. Census Bureau is exploring how to provide linkages to comprehensive employment and earnings data that go well beyond the unemployment insurance (UI) wage record data used in state longitudinal data systems. The Manufacturing Institute will work with leading industry and professional certification organizations to explore how to provide individual-level data on industry and professional certification holders that can be linked to education, employment, and earnings data.

Federal and state government LMI systems have major limitations in guiding the investment decisions of students and workers in a more complex and dynamic public-private credentialing marketplace. First, these systems were designed to support macroeconomic policy, as well as to be used for long-term government planning, program management, and funding allocation to a government-financed and -regulated credentialing marketplace. On the demand side, public LMI systems were never designed to capture short-term dynamic changes and variations in employer skill and credentialing requirements, especially those outside government regulatory boundaries. They also cannot capture the millions of investment transactions of students and workers as they respond to changing employer requirements and seek new pathways to career advancement and earnings gains. Finally, government LMI systems do not have the capacity to collect complete employment and earnings data across the full spectrum of employment relationships in the new economy, including independent contracting.

## **BUILDING AN EXPANDED PUBLIC-PRIVATE DATA INFRASTRUCTURE FOR LABOR MARKET INFORMATION**

Federal and state governments could redesign and expand data systems and guidance tools to address these major changes and move into the roles now played by private-sector providers. As an alternative, they could help build an expanded public-private data infrastructure that could support a more open “applications marketplace” where

both government and private-sector LMI providers could access this data infrastructure while protecting privacy and proprietary information. In exploring this public-private open applications marketplace approach, two major questions must be addressed. First, what are the major stakeholder needs and use cases that are critical in developing applications? Second, what are the most promising technical foundations for this expanded public-private data infrastructure that should be explored further?<sup>4</sup>

### **Major Stakeholder Needs and Use Cases for Improving Credentialing Markets**

Government labor market information systems have been developed over decades to support macroeconomic policy, long-term higher education and workforce planning, and federal and state regulatory policies, as well as program administration and evaluation. They also have provided high-level and aggregated occupational information as well as consumer information for government-financed and -regulated credentials. Although government systems will still be needed to address these major functions, an expanded public-private data infrastructure for labor market information should address at least four major stakeholder needs and use cases.

**Employer talent sourcing in open talent networks.** From the demand side, employers should have better data to improve their end-to-end talent sourcing process within more open talent networks. This end-to-end employer talent sourcing process includes performance analytics of recent hires, employer signaling, talent outreach and engagement, applicant screening, on-boarding, development, and retention. This process will require better information on skills and credentials.

**Pursuing career, education, and credentialing opportunities.** From the supply side, students and workers should have better data to search for and pursue the full range of career, education, and credentialing opportunities. This includes developing online professional profiles, résumés, and portfolios; searching for career, education, and credentialing opportunities; applying for these opportunities; and managing ongoing professional development.

**Developing new education and credentialing options.** Also from the supply side, universities, colleges, and other talent service providers should have the data needed to improve service delivery to employers, students, and workers. This includes how to fill gaps in competencies and credentials between employer needs and student and worker profiles in a rapidly changing labor market.

**Guiding, financing, and managing risks in education and credentialing investment.** Students, workers, and public- and private-sector career advisors should have better information to guide prudent investment decisions in a constantly changing labor market. This includes information on the costs, risks, and expected returns from continuous investments in education and credentials over an entire career. A public-private data infrastructure and open applications marketplace also may enable greater investment and risk taking among government and private-sector investors and risk managers, since they could access better information for market-oriented government tools such as government student grants and loans and wage insurance, as well as similar private-sector investment tools and services such as income-sharing agreements (U.S. Chamber of Commerce Foundation 2017b).

Common to these four stakeholder use cases is the need for more comprehensive, real-time, and granular information to guide and manage the risks of short-term skills and credential investment decisions of employers, students, and workers in constantly changing national, state, and regional labor markets.

### **Promising Technical Foundations for This Expanded Data Infrastructure**

Next, what are the implications of these stakeholder needs and use cases for developing an expanded public-private data infrastructure? Private-sector and government innovations provide lessons learned that can be applied to address these stakeholder use cases, including the need for public-private data standards and the potential power of Web 3.0 technologies as addressed in the U.S. Chamber of Commerce Foundation's T3 Innovation Network initiative (U.S. Chamber of Commerce Foundation 2018).

**Public-private data standards.** Private-sector innovations demonstrate the need to establish public-private data standards for describing the major features of jobs, credentials, credentialing organizations, and credential holders. These standards will leverage the power of the Web to promote transparency and promote the integration and interoperability of data systems as they manage and capture labor market transactions. Standards are critical in capturing the millions of transactions in the labor market necessary to generate ongoing labor market information.

Federal and state government reporting systems and regulatory policies have established definitions and vocabularies for credentials and credentialing organizations used in government policies and programs, but have not extended these efforts to the broader public-private credentialing marketplace. For example, federal and state agencies have made progress in aligning data standards across multiple government reporting systems through the Common Education Data Standards (CEDS). However, these efforts now should be expanded to develop public-private data standards through a comprehensive list of descriptors of jobs, credentials, credentialing organizations, and credential holders.

Establishing and managing public-private standards requires collaboration between multiple public and private technical standards organizations, as well as the input of employers, students, and workers; credentialing organizations; government; and private investors. One of the most difficult challenges is standardizing how competencies are communicated in employer job profiles, education and training program and credential descriptions, and credential holder profiles.

Future efforts to develop public-private data standards should build on current efforts by leading technical standards organizations, particularly the Credential Data Ecosystem Mapping Team initiative, which includes all the major standards organizations in the credentialing marketplace, including CEDS, Credential Engine, the HR Open Standards Consortium, the IMS Global Learning Consortium, and Postsecondary Electronic Standards Council (PESC).<sup>5</sup>

**Web 3.0 technology utilization.** Private-sector innovations as well as recent innovations in government also show the potential power of Web 3.0 technologies to support an expanded public-private data infrastructure. These Web 3.0 technologies include Semantic Web standards

(e.g., Linked Data), distributed ledger technologies (e.g., blockchain), artificial intelligence, machine learning, and large-scale data analytics.<sup>6</sup>

Employers, education and training providers, students, and workers can increasingly use World Wide Web Consortium's (W3C) Semantic Web standards and related technologies to improve web search and discovery. On the demand side, search engines (e.g., Google), applicant tracking system vendors, and job-board vendors are leveraging Schema.org and other standards (e.g., the HR Open Standards Consortium) to improve the use of structured data in online job postings. The aforementioned U.S. Chamber of Commerce Foundation's job registry will build on these standards and applications to improve how employers communicate competency and credentialing requirements. On the supply side, Credential Engine is pioneering the use of Semantic Web standards in the development and use of its Credential Transparency Description Language (CTDL). Similar applications could improve how students and workers publish and use their professional profiles on the open web. Federal government agencies also are exploring how to use these standards to publish government statistics and related information. These federal government initiatives have major implications for how to use these standards to integrate government data into a larger public-private data infrastructure.

One of the most difficult challenges in building a new public-private data infrastructure for labor market information is how to provide access to employer, student, and worker transaction data while maintaining privacy and protecting proprietary information. The government collects records from employers on employment and wages, as well as individual-level data on government-financed and -regulated education, training, and credentials. However, access to government data is limited to specific purposes, primarily clustered around research and government program evaluation. Private-sector data providers also have millions of individual-level records, including résumé data, but often consider such records proprietary. Currently, neither government agencies nor private providers allow access to this data as part of an open applications marketplace.

Recent innovations in information technology now allow integration and use of these granular, individual-level data in open applications while managing the risks to the privacy and data security of employers, students, and workers. One promising approach is to utilize distrib-

uted ledger technologies (e.g., blockchain) in conjunction with smart contracts. Both the public and private sectors currently are exploring these technologies<sup>7</sup> for a variety of applications that require trust and privacy protection. Another opportunity for exploration is how semantic web and distributed ledger technologies can support artificial intelligence and machine learning applications as well as big data analytics applications.

## CONCLUSIONS AND POLICY IMPLICATIONS

Government has historically provided labor market information, including information on credentials to improve the functioning of labor markets in the United States. Over the last few decades, government LMI systems have been focused on supporting macroeconomic policy and long-term government planning, program management, and funding allocation for a government-financed and -regulated credentialing marketplace. Recent changes in the credentialing marketplace are raising the stakes on investment in credentials by employers, students, workers, and government in a dynamic public-private credentialing marketplace. This has created the need for more comprehensive, granular, and real-time labor market information down to the regional labor market level. At the same time, recent advances in information technology and the rise of new private-sector LMI providers have generated new questions about the technical foundations of government data systems and about the role of public and private sectors in providing labor market information.

The time is right to explore an expanded public-private data infrastructure and an open applications marketplace that do two things: 1) provide labor market information designed to address changes in credentialing markets and 2) leverage recent advances in information technology and related private-sector innovations. This new public-private data infrastructure should incorporate public-private data standards and Web 3.0 technologies.

This proposed approach has a number of implications for government policy. First, although government should have the primary role in establishing core economic indicators for macroeconomic policy, the

public sector should collaborate more with the private sector to develop data standards. Government policies should support current ongoing efforts to create these standards at a national and even international level. Second, current federal and state “open government” initiatives in the United States should focus more attention on publishing open-licensed data to the web based on Semantic Web standards and encouraging other private-sector partners to do the same. Federal and state governments also should work with private-sector partners to create a more comprehensive individual-level data infrastructure that can support an open applications marketplace while ensuring data security and privacy. Finally, government policy should ensure that the future open applications marketplace addresses the needs of all students and workers, including low-income and low-skilled workers seeking career advancement opportunities in the credentialing marketplace.

## Notes

1. For more information about Credential Engine, see “Fixing the Credentialing Chaos: A National Tool and State Application” by Ken Sauer and Stephen Crawford in Volume 3 of this book.
2. These schemas and standards are referenced in U.S. Chamber of Commerce Foundation (2017a).
3. For more information, visit <https://www.credentialengine.org/>.
4. The following section is based on a review of public-private data standards initiatives and Web 3.0 technology applications in talent markets referenced in U.S. Chamber of Commerce Foundation (2018), from a joint project, the T3 Innovation Network, funded by the Lumina Foundation.
5. This initiative is referenced along with the full list of standardization organizations in U.S. Chamber of Commerce Foundation (2018).
6. This is based on a review of Web 3.0 technology applications in talent markets in the U.S. Chamber of Commerce Foundation (2018).
7. For public-sector applications, see Cheng et al. (2017).

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