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Reimagining the Workforce Development and Employment System for the 21st Century and Beyond

Demographic shifts, technological advancement, and globalization are profound changes that have characterized the U.S. economy for more than four decades. These changes have fundamental implications for the nature of work: the demand for and supply of workers, the mix of jobs in the economy, the skill requirements associated with those jobs,

KEY FINDINGS

- The current approach to workforce preparation in the United States—a linear pipeline from kindergarten through 12th grade (K–12) education to possibly college and then a job—looks similar to how it did several decades ago, despite technological change, globalization, and important demographic changes.
- The current pipeline may be sufficient for some, but there are clear shortfalls that need to be addressed. For instance, segments of the workforce do not have access to clear and meaningful paths to retraining throughout their working lives when their skills become obsolete, and many employers struggle to find workers who possess the desired 21st-century skills.
- The United States needs an integrated, data-driven 21st-century workforce development and employment system to ensure that people have equitable access to opportunities for acquiring in-demand skills over the course of their working lives and to ensure timely and appropriate matching and rematching of skilled workers with jobs to which they are well-suited over their time in the labor market.
- Each stage of transformation from the current pipeline to a 21st-century system should be guided by (1) relevant data and metrics to track system processes and monitor outcomes; (2) tools to support the design of innovative solutions to system shortcomings, followed by rigorous testing to determine what works and what does not; and (3) mechanisms to disseminate, scale up, and further refine proven approaches. Such efforts will be necessary to achieve the data-driven, integrated, equitable, and responsive system needed today.

the associated wages and fringe benefits, and the employment context (e.g., where work is performed, the nature of the employer-employee relationship).¹ These shifts affect members of the workforce (current workers and new entrants); the education and training institutions that prepare them for work (including the leaders of those institutions and the teachers and trainers they employ); employers and their hiring, training, and compensation practices; and other institutions, such as unions and other labor market intermediaries.

Although nearly two decades have elapsed since the turn of the century, the U.S. workforce development and employment system still largely operates on a 20th-century model. There are numerous ways that the current model is failing to uniformly meet the needs of today's workforce, employers, and other stakeholders. Illustrative examples of these shortfalls include the following:

- **A lack of a clear pathway and supports for workers who need retraining.** Many workers today find that the initial skills they developed over the course of their education and training eventually become obsolete.² The current model does not have a well-defined way for workers to quickly adapt and acquire the new skills they need to succeed. Indeed,

many of the unemployed and those who have given up looking for work were displaced from a prior job because of technological change (e.g., automation) or other sources of shifting demand (e.g., trade) and find that their skills are no longer valued in the labor market.³ And displaced workers who are reemployed typically face a sizable cut in pay.⁴

- **Employers struggling to find workers with 21st-century skills.** Across occupations, there is greater demand for so-called 21st-century skills that go beyond routine cognitive skills and stock academic knowledge to capture competencies in such areas as information synthesis, creativity, problem-solving, communication, and teamwork.⁵ However, in survey after survey, employers report that they cannot find the workers they need and that skilled positions go unfilled.⁶
- **The increased risk on some workers because of the changing nature of work.** In today's economy, with the apparent growth of nontraditional work arrangements, such as freelance and contract employment,⁷ certain workers are less likely to access the features associated with traditional wage and salary jobs, such as well-defined career ladders and access to fringe benefits to buffer the risks associated with health care needs, accidents, injuries, disability, and the business cycle.⁸ This places more of the onus on workers to anticipate changes in job requirements, take on the risk associated with poor health or saving for retirement, and bear the cost of job training and retraining.
- **The slow evolution of educational institutions.** In spite of these changes, U.S. education and training institutions, in many cases, still follow a 20th-century linear pipeline, from K–12 education, to perhaps college, and then a job. Primary and secondary schools in the United States largely rely on learning models and curricula appropriate for the world of work 20 or 30 years ago and have been slow to adapt to the need to prepare children and youth to be lifelong learners. Postsecondary training and

Abbreviations

BLS	Bureau of Labor Statistics
COBRA	Consolidated Omnibus Budget Reconciliation Act
EETR	electronic education and training record
EHR	electronic health record
ISA	income-share agreement
K–12	kindergarten to 12th grade
OJT	on-the-job training
P–12	preschool to 12th grade
R&D	research and development
STEM	science, technology, engineering, and mathematics
UBI	universal basic income
WDB	Workforce Development Board
WIOA	Workforce Innovation and Opportunity Act

education institutions offer much the same structure of credentials and degrees and may be constrained in their ability to respond to the changing occupational mix and skill requirements of jobs in a timely way. For example, just 33 percent of employers in a recent national poll agreed that educational institutions were graduating students with the required skills to meet employers' needs.⁹

- **Outdated and siloed information.** Another limitation of the current system is that, despite the fact that system components and outcomes change, information is often siloed and outdated by the time it reaches decisionmakers. For example, employers and education and training institutions do not systematically share information in ways that allow schools to respond to changing employer needs. And prospective and current workers do not routinely have well-formed or accurate information about the costs and returns of the education and training investments they may make.¹⁰ In the case of high school-age youth, for example, guidance counselors and parents are often ill-informed about current or future job prospects and are thus unable to provide accurate information in support of their students' career choices.¹¹
- **Unequal access to work-related training.** Growing disparities in access to education and training then continue in the resulting employment outcomes.¹² While the United States has long relied on a mixed system of public and private financing of education and training, that model generates inequities on both fronts. For example, public funding for primary, secondary, and postsecondary education is unequally distributed, often based on where people live, as well as family circumstances.¹³ There is also the tendency for private investments in education and training on the part of employers to be directed disproportionately toward the more educated members of their work force.¹⁴ And workers with less education and lower earnings cannot self-finance the further acquisition of skills they may need. These inequities in access to

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human capital acquisition contribute in turn to disparities in wages, earnings, and lifetime incomes.

- **Too few ways to develop and try out new strategies, reforms, and policies.** In light of the limitations of the 20th-century institutional arrangements, various stakeholders in the system are seeking to introduce reforms, try new strategies, and modify policies. But such efforts at transformation are often piecemeal, with each sector focusing on its own institutional component of the system without engaging other parts or considering broader consequences. Further, there are no consistent or efficient mechanisms in place to build evidence—at a systems level—of what strategies do and do not work and to broadly disseminate lessons learned and best practices.

Need for a New Approach

These issues demonstrate the need to reimagine the workforce development and employment system with an approach cognizant of 21st-century needs. Drawing on a long history of systems thinking at the RAND Corporation, this report aims to illustrate how a systems-level approach can be used to more holistically evaluate the challenges of the current

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system and reimagine and redesign the workforce development and employment system of the future.

A systems-level approach requires identifying the following:

- goals of the system
- relevant stakeholders and institutions
- how the players are linked together
- how decisions are made and the incentives that shape the choices made
- information flows required to ensure informed decisionmaking and efficient outcomes
- barriers and disincentives that preclude achieving the desired outcomes
- sources of inequity and exclusion
- the federal, state, and local policy environment that can address market failures and otherwise provide incentives (or counteract disincentives) to achieve the system objectives.

A systems perspective can be used to provide insights into interventions, strategies, and policies that can address specific weaknesses in the current system. Such initiatives may involve incremental shifts (i.e., the key institutions remain the same but their roles and operations may change) or perhaps eventually more-revolutionary changes (i.e., there are

fundamental changes in the institutions themselves). Ultimately, we envision a workforce development and employment system that can self-diagnose and address the issues with the current system that we described earlier, informed by existing and emerging research and aided by advances in technology. Such a system would facilitate greater connectivity across stakeholders, with rapid exchange of real-time, high-quality information to support decisions on the part of workers, educators and trainers, and employers, along with other stakeholders.

A reworked system, for example, would link current and future workers with education and training providers, employment opportunities and employers, and other key stakeholders (e.g., social service providers that support low-income workers, labor unions, and other worker organizations) across the workforce development and employment system. The system and its various actors would be more agile in their ability to respond to changes in skill requirements, the market for products and services, and other emerging trends. The system would incorporate mechanisms (e.g., public incentives) for researchers and stakeholders to evaluate policy changes, digest lessons learned, and contribute to the knowledge base of what does and does not work. Many of these new features would exploit current and emerging technologies that reduce the cost of collecting, analyzing, and disseminating information. A key consideration will be how to ensure equal access to information and other resources so that the system simultaneously promotes equity in opportunities and efficiency in matching.

In undertaking this reimagining exercise, our research approach included drawing on relevant literature to diagnose the issues with the current workforce development and employment system, developing a framework for a 21st-century system, identifying potential strategies for transformation based on a scan of promising initiatives, and outlining an evidence-based approach to efficiently support the transition to an effective reimagined system. Our process also included a series of interactive brainstorming sessions with more than 30 RAND colleagues from multiple disciplines and substantive areas of expertise—economics,

education, health, labor markets, military manpower, policy analysis, psychology, sociology, statistics, and technology—who brought diverse perspectives and varied expertise to bear on the systems approach, shortfalls of the current system, gaps in our knowledge, and potential solutions.

At this stage, we do not aim to identify all of the solutions for achieving a 21st-century workforce development and employment system, and we acknowledge that efforts are underway to enhance individual system components in light of the 21st-century context. Rather, we posit that a systems approach can provide a constructive framework for considering policy options, and a data-driven approach can support an efficient pathway to a reworked system, identifying, integrating, and scaling evidence-based initiatives. A number of these promising approaches are featured in the text boxes in each section.

Organization of the Report

The next section begins with an overview of a systems approach and the advantages it can bring to transforming the workforce development and employment system. We then consider the implications of a systems framework for achieving two central goals of the workforce development and employment system:

- ensuring that individuals have equitable access, throughout their working life, to opportunities for acquiring the skills that are in demand in the labor market
- ensuring timely and appropriate matching and rematching of skilled workers with jobs to which they are well suited over their time in the labor market.

We discuss these goals and related outcomes in depth in the remainder of this report. As part of those discussions, we address the institutional features needed to support those objectives; the role of signaling and information flows; incentives/disincentives, costs, risks, and returns; and aligning public and private (e.g., employer-based) policies to support the system. The final section makes the case for a learning agenda to advance research and policy analysis within a systems approach.

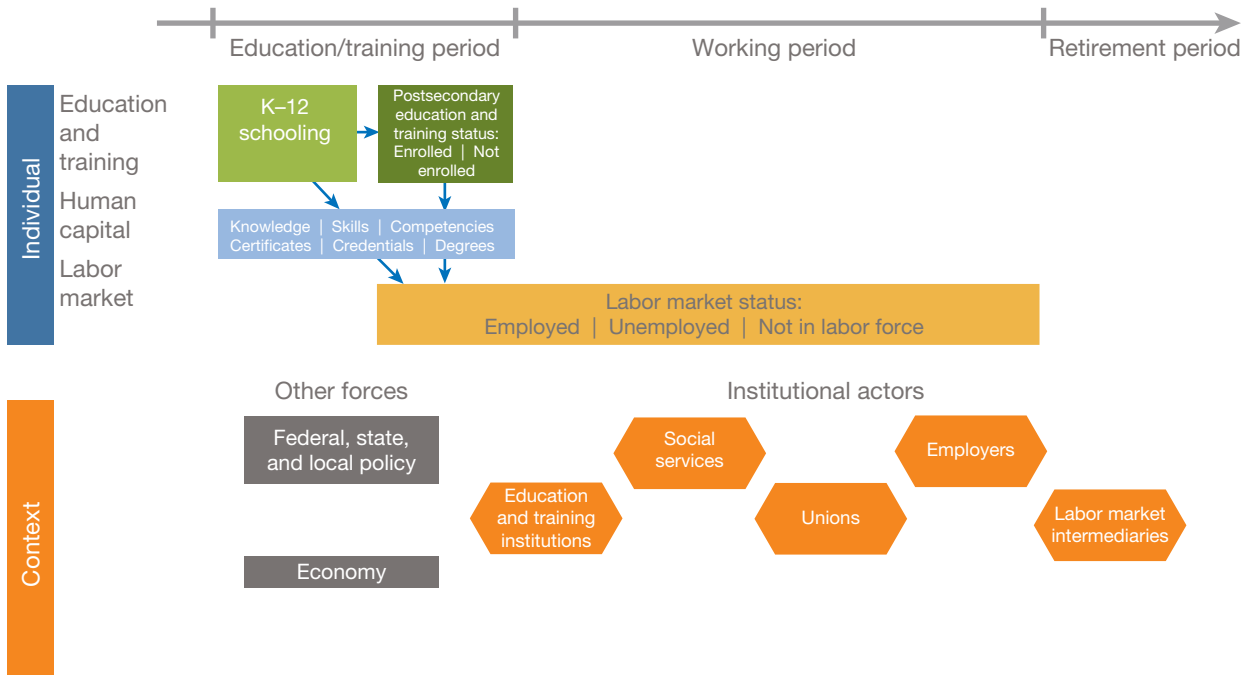
A Systems Framework for the Workforce Development and Employment System

For much of the postwar 20th century, the process of preparing for and then entering the labor market could be described as a simple, linear trajectory: starting with P–12 education followed by a direct transition to a job or, in some cases, further postsecondary education before beginning a career (see Figure 1).¹⁵ Employment could be a wage and salary job or self-employment, but there was often an expectation of a relatively stable employment trajectory over an individual’s working life, and often, lifetime employment with the same company.¹⁶ The skills acquired during the schooling period, plus any on-the-job training (OJT), would be sufficient to ensure employability throughout an individual’s working life. Where preemployment training was insufficient, the employer would take responsibility for providing additional education and training. For much of the 20th-century labor market, there were important changes in technology and the economy went through periods of greater openness to world markets, but the pace of change was arguably slower. For example, it was not as critical for education and

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Figure 1. Traditional Paradigm of the Workforce Development and Employment System

21st-century paradigm: A linear, segmented system



NOTE: Blue arrows show movement across education and training, human capital acquisition, and the labor market.

training institutions to communicate with employers about their future workforce needs, thereby providing little incentive to break down the silos that limited information exchanges between these two stakeholder groups.

As the pace of technological change accelerated and other forces—such as globalization and shifting product demand associated with changing demography—gained momentum, a stable labor market gave way to one with a shifting composition in the skills employers needed, shorter job tenures, weakened institutions (e.g., unions), and greater uncertainty. Previously, individuals needed one training period—in a specific technology—that was then used in a single career (e.g., machinery in a factory). Now, individuals may need to use several technologies even within the same career. Given these features of 21st-century labor markets, policymakers and other stakeholders in the system have an even-greater need for a comprehensive view of workforce development and employment, one that captures the interrelated aspects of the system and the implications for policy. Decisionmakers can no longer afford to myopically consider only

the immediate demands of their own sphere; instead, they must understand the dynamics and interrelationships of other system components to accurately forecast evolving needs.¹⁷ In this context, we focus in this section on the advantages of a systems-based framework.

A *systems framework* adopts a holistic approach and considers how the constituent parts of a larger system are interrelated. In the context of the workforce development and employment system, it recognizes that individual actors make decisions that influence and are influenced by the decisions of other actors within the system, where those actors are part of stakeholder groups, such as current or future members of the workforce, employers, and leaders of education and training institutions, as well as other stakeholders attached to the system (e.g., unions; labor market intermediaries; social services agencies; policymakers at the federal, state, and local levels). A systems framework provides an opportunity to shift from viewing processes as a set of linear steps (e.g., schooling first, then work) toward more-complex processes with simultaneous activities (e.g., combining school and work) and cycling

The framework articulates the overriding goals of the system, the stakeholders of interest, the outcomes for individuals in the system, the factors that affect stakeholder decisionmaking, and the role of policy and the state of the economy.

between activities (e.g., schooling, work, and return to schooling). A systems lens also accommodates moving from a focus on stocks (e.g., knowledge and skills acquired at a point in time) to flows (e.g., a continuous process of knowledge building and skill acquisition). A systems approach recognizes the interconnections between different stakeholders and the resulting need for shared information and collaboration to achieve efficient outcomes. It also points to the collateral effects of barriers in one part of the system for other system segments. Likewise, changes in one part of the system will have consequences for other parts of the system, whether intended or unintended. Thus, it is important to consider the systemwide effects of interventions in one part of the system and the potential for impacts to be muted when effects across the system counteract each other or to amplify as a result of synergies. Assessments of the effects of interventions in one part of the system from individual subsystem analyses may be an insufficient basis from which to draw conclusions about systematic changes—the overall effects are potentially more far-reaching than the sum of these subsystem effects.

In the remainder of this section, we present a high-level framework that captures the essential elements of the systems perspective.¹⁸ The framework articulates the overriding goals of the system, the stakeholders of interest, the outcomes for individuals in the system, the factors that affect stakeholder decisionmaking, and the role of policy and the state of the economy. We present a generalized framework that applies to current and potential workforce members, firms and employers, and other stakeholders in general, but it can readily be applied

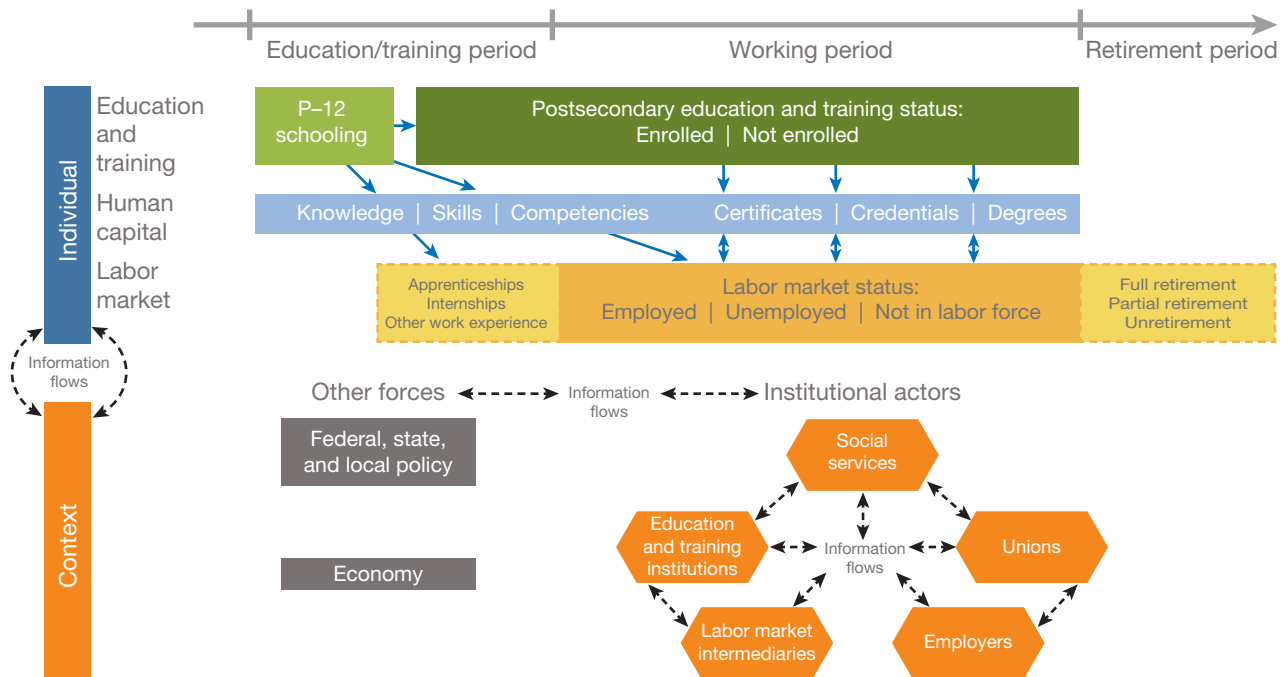
to specific subpopulations of the workforce (e.g., veterans, individuals living with disabilities, those who were formerly incarcerated), specific sectors of the economy (i.e., industries), or specific geographies. We illustrate a simplified version of the many factors that may alter an individual's lifecourse and therefore affect the ways in which someone may interact with the system. In offering a more simplified view, we aim to capture important dynamics of the overall system, especially in light of the evolving trends, without making the framework so complex so that it is no longer useful. For example, inherent in the system are such forces as biases and other social constructs, institutional barriers, advantages and opportunities, and other personal and institutional variables that cannot all be appropriately captured in a high-level systems illustration.

System Overview

In Figure 2, we posit a 21st-century workforce development and employment system that begins with *individuals* (represented in the top half of the figure) who make decisions about education and training (green boxes) and employment (gold boxes)—not just at set transition points but over the lifecourse. Their education and training experiences affect their acquisition of human capital (blue arrows to the blue box), manifested in the knowledge and skills they acquire, along with broader competencies, and documented in certificates, credentials, and degrees. These aspects of human capital are then deployed in the labor market (continuation of the blue arrows), where human capital may continue to develop. (Family and other personal factors may

Figure 2. A Reimagined Workforce Development and Employment System

21st-century paradigm: An integrated, multipath system



NOTE: Blue arrows show individuals' movement across education and training, human capital acquisition, and the labor market. Black dashed lines indicate information flows across actors in the system or across parts of the system. P-12 = preschool to 12th grade.

come into play, although these are not explicitly displayed in the figure.) Shown in the lower half of the figure, the system and its outcomes are also influenced by key *institutional actors*, such as leaders of education and training institutions, employers, unions, and other institutional entities (orange shapes). The behavior of individuals and the institutional features are further shaped by *public policies* established at the local, state, and federal levels, as well as *economic conditions* manifested at the local, national, and global levels (both in gray boxes). The actors in the system are connected through information flows (dashed black lines), as well as the ways in which costs and subsidies, risk-sharing, and incentives (or disincentives) affect decisionmaking.

Key Stakeholders in the System

In the reimagined system, actors from stakeholder groups are interconnected in a variety of ways (both by direct interactions and by information flows¹⁹), although each operates within and affects the system in specific capacities as follows:

- **Individuals:** During childhood—together with parents and caregivers—people make decisions about schooling and other aspects of human capital acquisition.²⁰ Then, as adults, they make decisions about additional schooling and training together with decisions about work, other activities (e.g., caregiving), and other life choices (e.g., marriage, child bearing, migration). An individual's status with respect to health, disability, or incarceration, among others, is an additional factor that affects opportunities and choices with respect to education, training, and work.
- **Education and training institutions:** Public or private providers of education and training across the spectrum from early learning to K-12 schooling to higher education and vocational training make decisions about learning objectives, curricula, and pedagogy, as well as the structural and process features of their programs (e.g., class sizes, teacher qualifications) that affect costs, quality, and learning outcomes. The actors within

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these institutions include the educators and trainers, along with their administrative leaders and governing boards. Related institutions include accreditation bodies.

- **Employers** (or firms): Representing different industries, employers (including the military) make decisions about the goods and services to produce and the required levels of employment and types of jobs to achieve those outputs, as well as choices about the nature of the work environment, the structure of compensation, and how much to invest in developing the skills and competencies of their workers.
- **Unions and other worker organizations** (e.g., guilds): These organizations are intermediaries between firms and workers and help negotiate compensation and working conditions. In some sectors with nontraditional employment arrangements, such as construction or the arts, trade unions or guilds provide access to continuous benefits (e.g., health insurance), opportunities for skills advancement (e.g., apprenticeships), information about job openings, and other workforce-related services.
- **Other labor market intermediaries:** Social welfare programs and local workforce investment boards under the Workforce Innovation and Opportunity Act (WIOA) provide targeted job-search services and job-training supports for individuals or for the workforce more generally.

Whether—and how—these various stakeholders interact with one another can shape the static features of the system, how the system operates, and the resulting outcomes. As discussed later in this

section, the incentives these stakeholders face, their interactions, and their resulting choices also are affected by and in turn affect outside forces, such as *policy* at the local, state, and federal levels and the *state of the economy* at large.

System Objectives

While there are many outcomes that can be associated with the system as we have framed it, we argue that there are two key objectives for the workforce development and employment system that are relevant today and likely will remain important well into the future, even as technologies and institutions continue to change:

- ensuring that individuals have equitable access throughout their working lives to opportunities to acquire skills that are in demand in the labor market
- ensuring timely and appropriate matching and rematching of skilled workers with jobs to which they are well suited over their time in the labor market.

These two goals reference several key concepts worth noting. First, they refer to skill acquisition, skills in demand in the labor market, and skilled workers. We use the term *skill* to reference the broad set of competencies, knowledge, and understanding needed to successfully perform the tasks associated with the range of individual jobs in the U.S. economy. Jobs and workers will vary in the skill mix required or available, respectively, whether those skills are manual or technical skills, cognitive or analytic skills, or interpersonal or soft skills.

Second, both goals refer to the individual's *working life*; recognizing that the process of acquiring skills for labor market success is

expected to be a lifelong, nonlinear endeavor. Skill attainment may occur through structured education programs leading to a degree or other credential, formal training programs to develop generalized employment skills or specific vocational skills, or employment-based formal or informal OJT. Likewise, matching workers with employers is expected to occur repeatedly throughout the lifecourse, as individuals move in and out of the labor market over time for various reasons and employers restructure jobs over time in response to changing business needs, general economic circumstances, and other factors.

Third, the goals convey that the system should be designed to promote *efficiency*, as well as *equity*. Achieving efficiency in the workforce development and employment system is often an implicit, if not explicit, objective.²¹ For example, the mission of the U.S. Employment and Training Administration of the U.S. Department of Labor is to “contribute to the more efficient functioning of the U.S. labor market.”²² To promote efficiency, for instance, the matching and rematching of workers to jobs would ideally occur with minimum churning or poor skill matches, which is costly for both workers and employers, balanced against the cost of lengthy job or candidate searches.

The evidence cited earlier of persistent gaps in access to education, training, and labor market opportunities for workers defined by gender, race, ethnicity, geographic locale, and other personal characteristics calls attention to the importance of addressing inequities in the current system as part of a reimagined workforce development and employment system. Research suggests that efforts at improving equity of opportunity are successful;

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for example, public need-based aid programs not only level the playing field in access to higher education,²³ but they also reduce costs for students who would traditionally face many financial barriers to on-time graduation,²⁴ bringing additional skilled workers to the labor market. Circumstance should not be a barrier to accessing opportunities for skill development, although equitable access does not guarantee equitable outcomes (e.g., individuals may differ in inherent ability). An equitable system could, however, provide ways to reengage those who, through no fault of their own, are adversely affected by technological change, globalization, health conditions, disabilities, or other factors that result in job loss, difficulty in attaining a job, and skills becoming obsolete.

With these explicit goals associated with a reimagined workforce development and employment system, it is possible to assess how well the current system is achieving these objectives. They also become the standard by which to evaluate the effectiveness of any incremental or systemwide reforms.

Outcomes for Individuals Within the System

To illustrate potential outcomes of the system, we consider the individual-level perspective (see upper half of Figure 2). On the left, we show an individual, operating within his or her personal context, who makes decisions about education and training engagement (first row) and labor market participation (third row), both of which contribute to his or her development of human capital (second row). Participation in education and training begins with P-12 education and then may follow with postsecondary education and training. At the high school level and beyond, education for noncollege-bound youth may include a more vocational focus. All of these education and training experiences shape the individual’s acquisition of human capital, which may involve the growth of skills and competencies and potentially the receipt of formal degrees, certificates, and credentials. Note that, in contrast to Figure 1, in this model, the pursuit of postsecondary education and training can occur throughout what would traditionally be an individual’s working-age

period and may occur simultaneously with formal or informal employment.

Participation in the labor market is represented in the third row, and this participation can occur simultaneously with various forms of education and training. Individuals in the early stages of their working lives may pursue apprenticeships, internships, or other prework experiences (dashed box on left) to develop human capital before seeking full-time formal employment. Within the working period, individuals may choose to be out of the labor force (e.g., to care for a family member) or in the labor force, and, once in the labor force, they may be employed in one or more jobs or be unemployed. Labor market experiences also shape human capital development informally through learning on the job or formally through OJT or employer-sponsored education and training. Individuals nearing the end of their working period may choose to retire (dashed box on right), and that retirement may be full (exiting the labor force), partial (reducing hours), or nonexistent. Some individuals may even “unretire,” transitioning from being out of the labor force and back to employment.²⁵

Choices made by individual labor market entrants, incumbents, and reentrants are also shaped by the policy environment and the state of the economy. These factors simultaneously influence the decisions made by the institutional stakeholders in the system, such as employers and education and training institutions. Information freely flowing throughout the system is key for decisionmaking for all stakeholders, in contrast to the siloed arrangement of stakeholders in the traditional system (Figure 1).

This simplified version of an individual’s lifecourse does not capture all of the many factors that may alter interactions with the system, nor does it illustrate the systemic forces that unequally affect individuals (e.g., biases) and all of the life events that change pathways (e.g., injuries, family care). Many other pathways—including military service—may also be possible for individuals who are not captured here. However, a systems framework, even a limited one, is necessary to monitor and modify the many complex institutions and processes involved in skill acquisition and utilization over the lifecourse.

With this stylized view of individual decisions with respect to education, training, and employment over the working life, we can highlight a number of the potential outcomes of interest, such as

- enrollment, persistence (continuation), and degree or credential attainment in education or training programs
- skills, competencies, and credentials of the current and potential workforce
- process of searching for work among new entrants, the existing workforce, and reentrants
- labor-force status and job context among the employed (class of worker, occupation, hours, compensation)
- sequence of jobs through time and their relationship to a career or other advancement.

We recognize that the system additionally affects other key outcomes, including possible short- or long-distance migration for schooling or work and decisions about family formation and childbearing, but these are not the central focus of this report.

For any of these outcomes, we can assess whether they are consistent with the system-level efficiency and equity goals stated earlier. For example, in focusing on education outcomes and skill acquisition, we can evaluate whether the outcomes are realized with an efficient use of resources based on a comprehensive analysis of the resources required to achieve the outcomes (i.e., a cost-effectiveness analysis). Some outcomes, such as long search times for new entrants to find a first job or long spells of unemployment, are themselves direct indicators of inefficiencies in the system. From an equity perspective, we can ask whether differential outcomes across population subgroups are the result of systematic inequalities in the system or variation that we would expect to see given differences in personal preferences and other factors that affect individual choices within a system that provides equity in access to opportunities.

Decisionmaking: Expected Costs and Expected Returns

Decisions made by individuals, employers, leaders of education and training institutions, and other key

A system-level understanding of the role of information in decisionmaking becomes particularly important where stakeholders' information is incomplete or inaccurate and when there are opportunities for improving information flows.

stakeholders will be shaped by system-level factors (Figure 2), such as information flows, expected costs and returns, and uncertainties and risks that themselves are affected by policy choices in the private and public sectors, as well as the state of the economy and other factors. For example, the human capital framework in economics assumes that individuals considering an investment in postsecondary education or training will compare the upfront costs of the investment (e.g., tuition and fees, forgone earnings while in school) with the future returns (e.g., the expectation of higher earnings and fringe benefits, as well as other private benefits).

Optimal decisionmaking requires that individuals have complete information about both the costs and expected benefits of the human capital investment. However, individuals making these choices—whether youth embarking on a vocational training program or enrolling in higher education or unemployed adults seeking to retrain for a new occupation—may have incomplete, inaccurate, or out-of-date information, especially about the future path of employment and compensation once they complete the program or degree.²⁶ This may lead to economy-wide underinvestment or overinvestment in the skills, degrees, and credentials from the perspective of the labor market overall. Human capital investment decisions will also be affected by policies that alter who bears the cost of the investment (e.g., the amount of public subsidies for education and training or the extent of employer-provided training) and the uncertainty associated with costs or returns. Limitations on the ability to borrow against future positive returns (also

known as *liquidity constraints*) and the absence of markets to insure against certain outcomes (e.g., variability in future earnings) can further constrain decisionmaking and lead to suboptimal outcomes.

Likewise, on the employment side, business leaders rely on information about the supply of workers with specific skill sets and the cost of that labor (including OJT) when making decisions about how to combine labor inputs with materials and capital (e.g., technology, equipment) to produce goods and services. Whether employers are willing to invest in the skills of their workforce involves a similar calculation of expected costs and returns. For example, the general expectation is that employers will be more willing to invest in firm-specific skills (i.e., those not valued elsewhere in the labor market), as workers who receive employer-provided training in general skills (i.e., those valued elsewhere in the labor market) can more readily switch to a better-paying job once trained, with the firm that provided the training losing the return to its investment in the worker.

Thus, a system-level understanding of the role of information in decisionmaking becomes particularly important where stakeholders' information is incomplete or inaccurate and when there are opportunities for improving information flows (see Figure 2). Understanding the individual and institutional perspectives as described earlier highlights the need to recognize the costs associated with choices facing the various stakeholders, how those costs are distributed, and how shifts in the cost burden may alter the incentives that stakeholders face when making decisions. Finally, these systemic relationships point to the role that

risks and uncertainties, liquidity constraints, and other barriers can play in determining outcomes. Understanding these aspects of the system and their relationship to outcomes can then lead to consideration of interventions or policies that address information flows, incentives (or disincentives), risks and uncertainties, liquidity constraints, and other market failures to achieve more-efficient or more-equitable outcomes.

The Role of Policy and the Economy

Policies—from the federal level to the organizational level (e.g., employers and education and training institutions)—are ubiquitous across all parts of the workforce development and employment system (see Box 1 for an example of the most recent federal policy on workforce development). The impact of such policies on skills development and labor market outcomes can be profound. The regulations that govern education, training, and labor market systems have implications for systemic innovation, scaling, cost, equity, and many other factors.²⁷ Some policies, despite having a clear rationale in the past, may now hinder system innovations that could benefit workers, firms, educational institutions, and training programs (e.g., reoptimizing occupational licensing requirements²⁸). There may also be a need for new policies to address market failures that are now more consequential than they were in the past (e.g., increasing market concentration

and monopsony²⁹). Another consideration—as options for virtual education and training expand, as distance work becomes more prevalent, and as labor markets in some sectors cross political boundaries—is when national-level policy would be more appropriate versus allowing for policy to vary across states and localities (e.g., in such areas as labor laws, unemployment insurance, and workers' compensation).

Broad economic conditions—whether local, national, or global—are especially relevant to the labor market side of the workforce development and employment system. Economic slowdowns can stall firms' plans for employment growth or lead to net employment reductions, as was the case in the Great Recession in 2008. During periods of economic recovery, labor demand may exceed supply overall or for certain types of skills and occupations, leading not only to wage increases but also to the use of other strategies (e.g., more-generous fringe benefits and working conditions) to attract and retain the desired workforce. Given the expectation that the periods of boom and bust will continue to characterize the U.S. economy, the structural features of the workforce development and employment system need to facilitate an approach that is responsive to both upswings and downswings.

Box 1. The Workforce Innovation Opportunity Act

Signed into law in 2014 to replace the Workforce Investment Act of 1998, WIOA aims to facilitate success in the labor market by helping workers access the education and training needed and helping employers match with a trained workforce. WIOA initiates reforms at the federal, state, and local levels. Through WIOA regulations, policymakers are encouraged to better integrate costs across governmental levels, especially at the local level. Compared with the Workforce Investment Act, WIOA places greater emphasis on states incorporating the needs of employers into workforce development planning and implementation. WIOA programs also aim to benefit especially vulnerable populations, such as people with disabilities, at-risk youth, and dislocated workers. Some innovative policy changes that have resulted from WIOA have been more-transparent accountability standards, such as required reporting on populations served by workforce investment programs and raising the out-of-school youth eligibility age from 21 to 24, allowing more young adults to potentially benefit from WIOA funds.¹

¹ U.S. Department of Labor, "The Workforce Innovation and Opportunity Act," webpage, undated-d; Kisha Bird, Marcie Foster, and Evelyn Ganzglass, *New Opportunities to Improve Economic and Career Success for Low-Income Youth and Adults: Key Provisions of the Workforce Innovation and Opportunity Act (WIOA)*, September 2014).

The evolving economy now and in the near future will require a mix of skills and competencies, not all of which will require a four-year postsecondary degree.

Desired Features of the System

The systems framework we have outlined in this section can provide the basis for identifying weaknesses in the current system and designing interventions, strategies, and policies that could lead to better outcomes in the future. Some flaws may require modest changes in public- or private-sector policies, ones that can be accommodated within the existing institutional structures. As technologies continue to change and the world of work evolves in ways we may not even imagine today, there may be a need for more-fundamental changes in how we approach education and training over the lifecourse to meet the needs of the future labor market.

Regardless of the institutional arrangements at any given time, we can anticipate that the workforce development and employment system would exhibit a number of key features that would support the system goals of efficiency and equity. Those features include

- **strong connectivity** across stakeholders that supports rapid exchange of accurate and timely information to support the decisions made by workers and leaders in education, training, and business
- **flexibility and responsiveness** to changing circumstances in the short and longer terms, whether in the skill requirements of jobs, the market forces shaping the demand for goods and services, or other unanticipated changes
- **aligned incentives**, through private or public policies, to support system goals and promote the desired outcomes
- **use of data and evidence-based practices** that support monitoring system outputs and outcomes, identifying needed reforms, testing

interventions, sharing lessons learned, and effectively scaling up proven remedies.

A reimagined system would be structured to take advantage of technologies that promote information flows, support equitable access to opportunities, and facilitate information gathering for monitoring, evaluating, and advancing the functioning of the system.

The remainder of the report is organized around the two objectives we articulated for the system—equitable acquisition of relevant skills throughout the lifecourse and timely and appropriate matching and rematching of skilled workers—while considering such issues as the institutional features needed to support those objectives; the role of signaling and information flows; incentives and disincentives, costs, risks, and returns; and the alignment of public and private policies to support the system.

Equitable Acquisition of Relevant Skills Throughout the Lifecourse

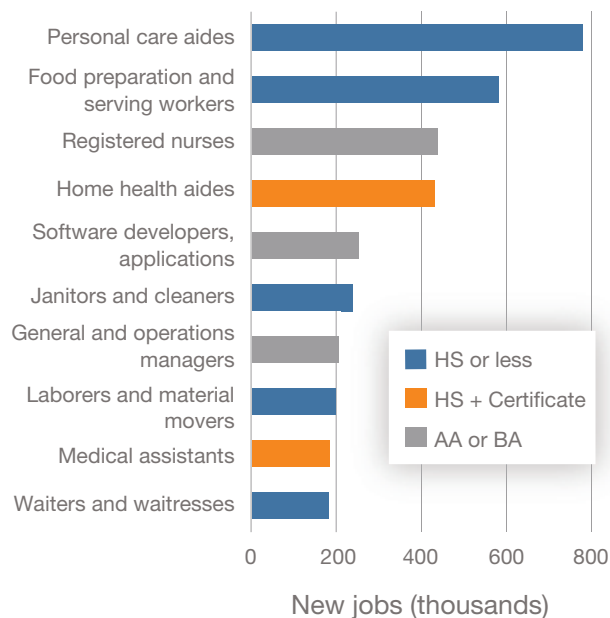
The evolving economy now and in the near future will require a mix of skills and competencies, not all of which will require a four-year postsecondary degree. For example, Figure 3 shows the ten occupations projected by the U.S. Bureau of Labor Statistics (BLS) to add the greatest number of new jobs to the economy over a ten-year horizon. As shown by the coloration, only three of these occupations require a formal degree beyond high school. Of these ten occupations, four are also among the 20 occupations with the largest projected rate of growth between 2016 and 2026 (personal care aides, home health aides, software developers, and

medical assistants).³⁰ As growth occupations and industries evolve, education and training institutions need to be primed to make responsive changes in program offerings while ensuring accessibility to individuals seeking skill development throughout the lifecycle, requiring the increased connections detailed in Figure 2. With their comparatively shorter time frame between program and workforce entry, sub-baccalaureate credential programs can play an important role in facilitating this agility and accessibility.

Most people enter higher education because they believe it will increase their probability of maintaining gainful employment.³¹ However, as shown in Figure 3, many growing occupations do not require any postsecondary degree, instead favoring appropriate certification and possibly OJT. This may be good news for job seekers, as OJT allows for quick adaptation to changing skill needs in the field, and employers willing to provide such training may consider a wider range of applicants and skill levels. Although jobs that incorporate OJT better position employees to adapt to their fields, education centralized with employers, as in OJT, is not without risk. Workers might be constrained to acquiring skills that will be applicable only in a limited career trajectory or to jobs that are likely to become partially or fully automated in the future, creating a potentially unsustainable skills treadmill for those in rapidly evolving fields.³²

Automation of jobs is an increasing concern for displaced and current workers, as well as policymakers, despite conflicting evidence on the impact of automation on the number of jobs that will be available in the long term.³³ From World War II to 2000, productivity (measured by real output per hour per person) and total employment in the United States tracked closely; in 2000, the productivity line continued to increase while employment growth tapered. Some economists attribute this directly to advanced technologies.³⁴ Some argue that this technological revolution will be temporary, akin to previous revolutions, and there will not be a long-term shortage of jobs, while others point to artificial intelligence advancements and the increased “humanization” of robots to argue that automation may be a major issue of concern.³⁵ Others argue that

Figure 3. Top Ten Occupations with the Greatest Projected Absolute Job Growth from 2016 to 2026 and Associated Education Requirement



SOURCE: BLS, 2017.

automation will likely be partial, will be focused on individual tasks, and will change the kinds of employees that are hired (i.e., technicians instead of laborers) and the skills that are in-demand rather than overall employment.³⁶

Jobs that require credentials from formal programs are typically not able to respond as quickly to changing employer or industry demands. Accreditation and rigidities in the educational system mean that institutions are slow to change (e.g., one accrediting institution states that initial accreditation typically takes one and a half to two years³⁷). Educators and educational systems often lack incentives or opportunities to keep up with changes in the field and implement new pedagogical methods. Despite their associated rigidities, credentialed jobs are often more sought because they are perceived as good, family-sustaining jobs—jobs that tend to have higher wages and more stability—than jobs that do not require formal credentials.

This tension between the forecasted growth in certain industries and the opportunities to deliver agile and responsive training—along with mixed

From automation and artificial intelligence to online education and algorithmic job matching, technology has become both a facilitator of advancement and a barrier to attainment in education and employment.

perceptions, often based on outdated information,³⁸ of where individuals feel they should invest their education and training time—leaves room for efficiency gains in the reimagined system. We see several potential areas for improvement, envisioning a multilayered workforce development system that routes current and future workers to appropriate institutions to easily update and enhance their skills in response to employer- and industry-driven skill needs. Such a system requires (1) that education and training institutions have certain features supporting adaptability and (2) that these institutions and the training they provide are both informationally and financially accessible, permitting the free flows depicted in the reimagined system of Figure 2. In the first section, we outline these desired features of education and training institutions, and, in the second section, we survey the incentives, traditional mechanisms, and innovations in postsecondary education and training finance.

Desired Features of Education and Training Institutions

In this section, we outline the features of a well-functioning and agile education and training subsystem that promote equity and efficiency. While many individual programs today may include elements of these features, they are often not connected in a systematic manner or designed with the labor market in mind.

A P–12 education system that teaches a broad base of fundamentals. While discipline and attention to detail were among the most critical skills taught by a system geared toward manufacturing,³⁹

today’s public education system needs to position young adults for equitable access to family-sustaining jobs in an ever-evolving skills marketplace and also prepare them for nonroutine, creative tasks.⁴⁰ Such a P–12 system would (1) develop and socialize literate, engaged citizens; (2) ingrain lifelong learning skills (the acquisition and evaluation of new information and resources); and (3) teach basic skills needed for a lifetime of work. Federal and state governments profit from an expanding economy and an employed and engaged citizenry, both from the tax rolls and from a decrease in social need.

Technology has become omnipresent in the workplace and in education. From automation and artificial intelligence to online education and algorithmic job matching, technology has become both a facilitator of advancement and a barrier to attainment in education and employment. Therefore, having a robust foundational education in technology is a fundamental skill for 21st-century work. In a 2013 study by Pew Research Center, 94 percent of adults in full- or part-time jobs use the internet at work in some capacity, and 46 percent felt more productive as a result of digital tools. Tech has enabled more flexibility in the workplace as well, with 59 percent reporting working outside of the workplace as a result.⁴¹ Technology also is more often used in classrooms, with 90 percent of educators having a computer in their classroom.⁴² Despite its increasing presence in the classroom, some individuals are not as practiced in using technology, potentially resulting in a widened gap for some learners because of differential access and abilities (e.g., by socioeconomic status or disability classification). However, if students are adequately

educated in using technologies, instructors benefit from an advanced ability to personalize education for different types of learners, such as those who are differently abled. Technological growth has also enabled on-demand, real-time learning and increased access to education for individuals without in-person opportunities. People across a wide variety of geographies (e.g., rural communities) can also connect and learn together. The integration of technology into P–12 education not only provides an opportunity for skill development but also facilitates new opportunities for socialization, engagement, and lifelong learning, potentially increasing equity in opportunity.

A secondary and postsecondary education and training system responsive to current and evolving needs. While the P–12 system builds a broad base of educational fundamentals, greater specificity in skill training can occur in high school and postsecondary systems. All high schools could expose students to career and technical education and could also include an introduction to the world of work, including career options, their associated pipelines, and regional and national earnings and employment prospects. Students intending to pursue higher education should receive instruction sufficient to prepare them for the reality of postsecondary course loads (currently, many students require remedial education⁴³). Improved awareness of job options may increase both equity and efficiency, and the P–12 system’s broad fundamentals-based education will facilitate an individual’s ability to adapt later in life. As skill needs evolve, so too can secondary and postsecondary general education classes; for example, extant computer literacy classes could be supplemented with basic computer programming and data-manipulation classes.

Along with this responsiveness, secondary and postsecondary institutions could provide opportunities for “just-in-time” or competency-based training for those already in the labor force seeking to supplement their current skill portfolio. Some community colleges have addressed this need through noncredit programs that can be stood up quickly in response to an employer’s need, and these shorter and less costly programs tend to have higher completion rates than traditional for-credit

programs.⁴⁴ At an educational institutional level, many four-year higher education institutions require some type of entrance exam. This could be a barrier to overcome for many nontraditional students who want to receive the necessary education and training needed for certain careers or professional development supplements. A viable option for better meeting current needs could be to modify the entry requirements of higher-education institutions for students seeking to further their credentials once they have already been in the workforce for five or more years.

Opportunities for displaced and transitioning workers to develop and maintain in-demand contemporary skills. While technology may be the cause of displacement for many workers, especially those with lower skill levels and those nearer to retirement, technology can also be part of the solution for gaining new skills that can enable new labor market opportunities. Both voluntary and involuntary separations from work—because of automation or other reasons—are opportunities to retool and invest in future employability. The Department of Labor’s American Job Centers (formerly One-Stop Career Centers) can provide career and educational coaching or case management to help displaced workers find appropriate, data-driven on-ramps for further training and dissuade

While the P–12 system builds a broad base of educational fundamentals, greater specificity in skill training can occur in high school and postsecondary systems.

them from programs with declining job prospects. This career coaching could be coupled with financial supports that enable retraining, including tuition and course costs and stipends for living expenses. Competency-based programs may provide additional opportunity for relevant upskilling at minimal cost. Digital microcredentials are certifications that workers can earn in specific topics or skills; they have the potential to ease transitions for displaced workers or workers seeking enhanced qualifications into new fields (see Box 2). These microcredentialing programs can be (and some already are) offered online by both training institutions and employers, and microcredentials are being explored as alternative or additional college admission criteria.⁴⁵ These kinds of on-ramps can improve efficiency by reducing unemployment and underemployment for those in declining fields.

Strong educator pipelines with incentives for continuous professional development. To ensure that all qualified and interested educators are able to engage in this system and that school systems can flexibly fill vacancies, school districts and states could consider alternative credentials for

career-changers (e.g., Delaware’s 91-day substitute teaching⁴⁶ and Transition to Teaching Partnership⁴⁷ programs); robust clinical/residency programs to prepare candidates to teach in a variety of educational environments; and fast-track, high-quality regional preparation programs to address specific teaching shortages.⁴⁸ Supports for current educators could also be strengthened. In contrast to conducting in-service days requiring substitute teachers, providing paid out-of-school time for individualized professional development⁴⁹ would provide the scaffolding for educators to align their instruction with evolving standards and skill needs, engage in learning communities,⁵⁰ and integrate new technology and pedagogical techniques. Peer coaching and mentoring can also support the diffusion of new techniques. Online programs for acquiring professional development credits or additional certifications have grown in popularity because they enable people to complete trainings on their own time, supporting diversity in who can enter or progress within the teaching profession. These programs must still be responsive to existing requirements around qualifications for

Box 2. Digital Microcredentials

Both Mozilla and Digital Promise have created platforms for digital microcredentials: nondegree certifications of expertise or training in a particular area. Digital Promise designed a series of competency-based microcredentials for educators,¹ allowing teachers to communicate their expertise in such areas as personalized learning, digital learning environments, and assessment design. In an annual survey of teachers by Digital Promise, approximately two-thirds of teachers reported being interested in pursuing microcredentialing.²

Mozilla’s Open Badges program,³ now run by IMS Global, provides a platform for organizations, employers, and communities of practice to assess skills and learning in a standardized manner and allows those pursuing the badges to communicate their knowledge or experience to employers in a verifiable manner. Topics include health, education, community experience, and technology.

Substantial research evaluation efforts in microcredentialing are still needed to validate their effects, although Digital Promise has leaned on research and evidence to craft its microcredential framework,⁴ and Mozilla Open Badges uses case studies and internal research to evaluate the implementation of the program.⁵

¹ Digital Promise, “Micro-Credentials. Macro-Rewards,” website, undated.

² Center for Teaching Quality and Digital Promise, *Micro-Credentials: Driving Teacher Learning and Leadership*, Carrboro, N.C., and Washington, D.C., 2016.

³ The Mozilla Foundation, Peer 2 Peer University, and the MacArthur Foundation, “Open Badges for Lifelong Learning,” working document, August 27, 2012.

⁴ Center for Teaching Quality and Digital Promise, 2016.

⁵ moz://a, “Open Badges,” webpage, undated.

accreditation, and many online degrees lack the prestige of in-person options. Improving digital means of obtaining skills and providing incentives to workplaces to create feedback loops with online institutions so they can strengthen their programs will encourage workers to learn new skills and meet certification requirements without concerns about educational institutions and workplaces not accepting the program because of accreditation or reputation concerns. Programs to facilitate credentialing of both educators and educational leaders have the potential to benefit students.⁵¹

Paying for Skill Acquisition and the Associated Risks and Returns

For the system to function as a responsive, equitable network, individuals from a variety of backgrounds need to be able to acquire new skills to maintain workforce relevance. However, acquiring skills is both costly and risky, and these costs and risks are generally borne by the individual. Educational institutions are often not fully accountable for the labor market outcomes of their students, as short- and long-term indicators of graduation rates and subsequent labor market earnings are not routinely and consistently collected or reported. Employability plays a key role in governing the long-term affordability of higher education, and student loan balances have more than doubled between 2008 and 2018.⁵² Some informational providers publish graduation rates, employment rates, and mean and median salaries, but there is so much heterogeneity by program within a school that these statistics are not particularly informative. Some states (Tennessee and Indiana) have made public funding contingent

on “completion management,” which helps align incentives toward graduation but is still not completely aligned with labor market outcomes.⁵³

Education and training costs are of interest to those receiving the training (students and employees), those requesting the training (employers), those providing the training (institutions), and those subsidizing the training (governments). However, none of these parties wants to finance education and training if they can find another institution to do so. All of these parties face some form of liquidity constraint—students are investing in training based on expected returns in future income, employers are willing to spend liquidity on training workers that is conditional on retaining those workers and recouping the investment, and institutions and governments face competing claims for their funding. Understanding the impact of costs and funding constraints of the current systems highlights critical barriers in updating the workforce education and training systems for the future.

Traditional Model of Funding Workforce Education and Training

The United States has a long history of public education dating back first to establishing schools in the early 1600s and then to making elementary education compulsory in all states in 1918.⁵⁴ In traditional U.S. K–12 public education, costs are shared among federal, state, and local governments. In 2013, state funds were the largest revenue source for school districts on average (approximately 46 percent), followed closely by local government (45 percent), with federal spending a distant third (9 percent).⁵⁵ In most states, a state-created formula

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Instructional costs have been rising faster than public subsidies, resulting in higher costs for students. In 2000, students paid a greater share of public higher education (relative to state subsidies) in just three states; in 2012, that was true in nearly one-half the states.

is used to determine how to distribute funding to districts. The formula usually accounts for student need, local property taxes, and local revenues; the formula does not typically account for variation in district average income independent of property values.⁵⁶ A local district's ability to pay is usually a function of its local property values and the municipal property tax rate.⁵⁷ After the 2008 recession, local districts have struggled to raise revenue for education through these taxes, with spending-per-student cuts in at least 18 states, and 31 states provide less support (per student) than they did prior to the recession.⁵⁸ As a result, school districts are incentivized to maximize enrollment to maximize public funding. This is usually accomplished through reputation and service provision—having high student test scores and offering a variety of classes and extracurricular amenities to attract new families to the district.

An estimated \$407 billion is spent on higher education in the United States annually.⁵⁹ Institutions' primary revenues are tuition and fees, investments, government grants, and contracts and appropriations; the proportion of each varies by institution type. Public institutions receive approximately 42 percent of revenue from government sources (e.g., federal, state, and local government contracts and appropriations), whereas private institutions are largely funded by student tuition and fees (90 percent at private institutions compared with 30 percent at nonprofit institutions). Community colleges also are largely funded through tuition, but state and local funding is particularly

important for operations (approximately 30 percent funded by the state, 18 percent locally).⁶⁰ One of the most noteworthy shifts in higher education is the rapid expansion of private for-profit higher education; the number of institutions almost doubled from 2000 to 2014,⁶¹ and although many institutions have closed because of stricter federal and state regulation, more than 1 million students were still enrolled in for-profit institutions in 2017.⁶² The growth of this type of higher education may have significant cost implications for students and lead to funding shifts by governments. Higher education costs can be broadly categorized into instructional costs (direct education) and maintenance costs (e.g., living and housing).⁶³ Instructional costs have been rising faster than public subsidies, resulting in higher costs for students. In 2000, students paid a greater share of public higher education (relative to state subsidies) in just three states; in 2012, that was true in nearly one-half the states.⁶⁴

Because the need for lifelong learning persists for workers, employers and other institutions are increasingly funding skill development and lifelong learning courses throughout a worker's career. These trainings may be run by private companies, labor unions, universities, nonprofits, safety organizations, and other entities (see Figure 4). Estimates suggest that employers spend \$177 billion on formal and \$418 billion on informal (on-the-job) workforce education and training annually.⁶⁵ A survey of Society for Human Resource Management members suggests that the majority (approximately 84 percent) of members' employers support professional

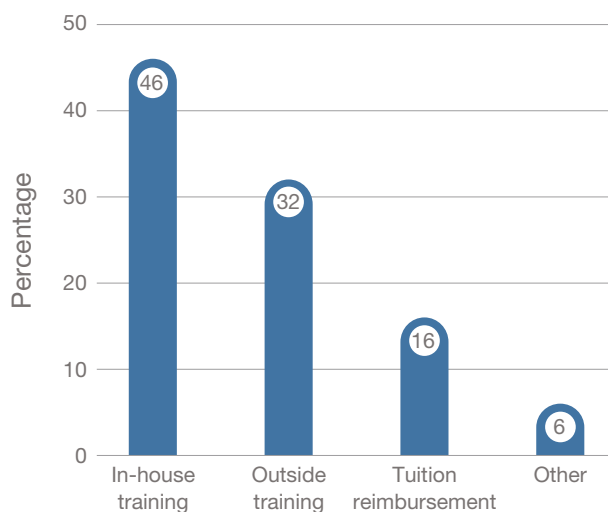
development or training benefits for employees, roughly three-quarters of employers provide funding for certifications, and just over 80 percent fund off-site professional development.⁶⁶

Disparities in who receives employer-sponsored training is apparent: Employers spend more than three times as much on training for college-educated workers than for workers with a high school diploma or less.⁶⁷ Annual surveys by the Society for Human Resource Management and the Association for Talent Development indicate that the number of employers offering these benefits has generally been staying constant or slightly increasing, whereas data from the Department of Education, BLS, and Government Accountability Office show a 26-percent increase in spending since 1994.⁶⁸ Despite the abundance of employer benefits available for training, it is estimated that less than one-third of employees in large companies and only 1 percent in small companies take advantage of these opportunities. These differences are profound across industries: finance, insurance, and real estate organizations spend double the amount per employee and provide nearly 20 percent more time for training than do manufacturing organizations.⁶⁹

Alternative Models of Funding Education and Training

As the costs of education and training rise, a workforce development and employment system will need to distribute costs such that optimal training is pursued and obtained. What alternative financing models are possible, given future evolution of skill requirements and needs of employers? Models may differ based on when education and training occur (e.g., prior to labor market entry versus incumbent workforce). These models may not be mutually exclusive; individuals following nontraditional paths may be launching into entry-level higher education programs after having entered the labor market or may be pursuing both education and the workforce simultaneously (see Box 3). Alternative models may also need to account for the changing nature of employment, such as the growth of the gig economy.⁷⁰

Figure 4. Employer Spending on Training



Share of annual spending by category, 2013

SOURCE: Carnevale, Strohl, and Gulish, 2015.

Numerous interventions have been implemented in a variety of settings in the context of K–12 education, higher education, and workforce training. In K–12 education, vouchers are rising in popularity nationwide. For example, the Milwaukee Parental Choice Program targets low- and middle-income students and is the longest-running school choice program in United States. The program has expanded to include most of the state of Wisconsin. Another statewide program for low- and middle-income students, the Indiana Choice Scholarship Program, has been in operation since 2011 and is now the country’s largest, with approximately 35,000 participating students.⁷¹ Also, leaning on technology as a cost-savings measure has increased in popularity in K–12 education: All but two U.S. states provide online learning opportunities as a supplement to or substitute for classroom-based education.⁷² The use of online systems to facilitate personalized learning has been adopted in numerous contexts as a way to deliver cost-effective, efficient, and adaptive learning for students.⁷³ Online systems have slight per-student and maintenance costs, and they can be updated and revised cheaply and quickly.⁷⁴ Capital costs are also often provided up front by private donors, foundations, and nonprofit organizations, which further reduces spending by the school.⁷⁵

Box 3. Starbucks College Achievement Plan Helps Curb Costs

To address the rising costs of college education, Starbucks and Arizona State University (ASU) launched a collaboration to help Starbucks employees, including those originally deemed academically ineligible, to gain access to a college education. The effort reimburses ASU tuition for employees and also established a program for employees who do not qualify for admission because of academic reasons or test scores to participate in an online freshmen academy as a pathway to admission.¹ Similar programs have been launched by other companies, including Chipotle, which is collaborating with digital learning platforms and colleges to enable employees to receive college credit, and Fiat Chrysler, which pays tuition up-front rather than as a reimbursement. Such company-sponsored education programs are ways to help defray costs of education for individuals, and companies can better train their workforce for more-advanced opportunities within the company.²

¹ Arizona State University, “Starbucks, ASU Online Partnership Expands with Pathway to Admission,” press release, March 22, 2017.

² Rachel Carlson, “College-Business Partnerships Can Solve the Higher Education Affordability Crisis,” *Forbes*, January 17, 2017.

The growth in cost of four-year undergraduate education (28 percent after inflation between the 2005–2006 and 2015–2016 school years among undergraduate institutions overall, and 34 percent among public institutions⁷⁶) has resulted in an increased financial burden that may deter many students. These institutions currently face a “cash-for-credit” incentive that may alienate low-income students, students who need long-term advising, and other nontraditional students. Researchers note that the disconnect between financial incentives and outcomes parallels the “fee-for-service” approach previously taken in U.S. health care, now being phased out in favor of a system that accounts for the differential risk rates of different consumers.⁷⁷

Innovative, incentives-aligned financing mechanisms for higher education are especially critical given rising costs. Purdue University is aligning incentives of its own volition through income-share agreements (ISAs) (see Box 4). ISAs are contracts between a student and a tuition funder (either an educational or financial institution) in which the student promises a set share of future income for a fixed term in exchange for payment of current tuition. Because the ISA provider nets a portion of the student’s future income, the provider is incentivized to (1) ensure that there is an income and (2) help to maximize that income. The provider of an ISA (the government, a school, or a private funder) is incentivized to ensure that the graduate quickly finds a high-paying job, potentially aligning incentives

toward the “value-based reimbursement” approach now favored by health care finance experts.⁷⁸

ISAs ensure that student loan payments do not bankrupt students, and they may also increase access to higher education for students who have exhausted federal aid options and lack a credit-worthy cosigner to pursue private loans. The San Diego Workforce partnership is deploying ISAs to help individuals from disadvantaged backgrounds enter tech careers through certificate programs at the University of California, San Diego.⁷⁹

There are also a growing number of programs for workers already in the workforce that are funded through employers or in-kind payments. For instance, the Apprentice School at Newport News Shipbuilding provides tuition-free trade-skill training while students work in the shipyard.⁸⁰ The company recoups costs of training through reduced turnover and a streamlined set of employee qualifications, potentially increasing overall efficiency. Companies in South Africa’s Go for Gold program⁸¹ provide participating students with a one-year internship at the end of science, technology, engineering, and mathematics (STEM)-focused high school; if the company likes the student, it will then sponsor his or her college education. An example of an in-kind payment program is the Pratham Institute for Literacy and Vocational Training,⁸² which allows program graduates and advanced students to tutor younger or less advanced students in exchange for skills training. These preemployment

Box 4. Income-Share Agreements

Purdue University recently introduced a new college financing mechanism through its Back a Boiler ISA program.¹ In an ISA, student borrowers sign a contract to repay a fixed fraction of their future income for a set term, rather than agreeing to a fixed payment amount. Income share agreements have become popular for coding bootcamps promising quick and gainful employment, but Purdue was the first major university to implement such a program. In Purdue's case, ISA borrowers who are unemployed or earn less than \$20,000 per year make no payments to the university, and there is a six-month grace period following graduation, providing some insurance against poor job prospects. If an ISA borrower is very successful, he or she may hit the repayment cap—2.5 times what was originally borrowed.² The exact repayment fractions and term lengths depend on a student's chosen major. To date, 500 Purdue ISA contracts have been written (a student might have more than one ISA contract), with funding totaling \$6 million. Since Purdue launched its partnership with Vemo Education to administer the program, several more universities have partnered with Vemo and will likely be watching closely as Purdue's first ISA graduates enter the workforce this year.

¹ Purdue Research Foundation, "Back a Boiler Program Overview," webpage, undated.

² Amelia Friedman, "Why One University Is Sharing the Risk on Student Debt," *The Atlantic*, March 15, 2017.

programs, shown in Figure 2, can provide a bridge between training and employment, particularly when educational institutions provide the infrastructure to facilitate these partnerships (e.g., Ivy Tech's Achieve Your Degree program⁸³).

Responsibility for rising education and training costs will continue to be absorbed by numerous stakeholders, from the individual student or worker to employers and the public sector. People will continue to hold primary responsibility for forging their own education and training paths and ensuring that they can secure funding from personal, public, or private sources to cover the costs. Similarly, benefits are reaped by all stakeholders.⁸⁴ Although many theories exist about why people decide to invest in their own education, ultimately education is both a public and a private good that leads to individual, institutional, and societal economic benefits and will likely continue to be funded.⁸⁵ A reimagined workforce development and employment system would employ innovative financing models that will provide an equity balance, facilitate the receipt of necessary training, and provide a sustainable method for employers to gain an adaptable workforce to meet their needs.

Many alternative financing models—including those discussed earlier—have not been objectively and independently validated as beneficial. The

Harvard Business School and McKinsey Social Initiative have argued that costs must be weighed against success rates. They have piloted a youth employment program called Generation, through which they are testing a newly developed metric to determine the success of employment training programs.⁸⁶ This new metric—cost per employed day—combines per-student returns with retention and persistence to better measure the "true" costs and benefits of an intervention. For example, a program with a low per-student cost but a short duration of benefit (e.g., continued employment) may be a less desirable program to pursue than one with a high per-student cost but a long duration of benefit.⁸⁷ Using cost per employed day or other customized measures of determining costs and benefits will be essential for weighing alternative financing models before adopting wide-scale implementation.

Policy Implications Surrounding Skill and Knowledge Acquisition

Shifting human capital requirements (in terms of acquired skills and content knowledge) raises a host of policy questions, such as the age for compulsory schooling and the age when publicly funded education should begin, how students should be organized in schools, how academic knowledge and

other skills should be acquired, and how students should be assessed and progress. The nature of credentials and degrees may need to be reconfigured, and methods for assuring the quality of varied degree programs reconsidered (e.g., accreditation for traditional institutions versus online institutions).

A goal of the reimagined system is equitable access to human capital opportunities, where access is represented in Figure 2 by the ability of individuals to freely move along the arrows connecting the labor market, education and training, and human capital. This section has highlighted three primary issues with access to human capital acquisition in the present system. First, education and training institutions are often unable to respond to changing skill needs in local labor markets and nascent industries. Second, individuals may be uninformed or misinformed about the costs and benefits of acquiring various credentials. Third, rising educational costs have affected access to training for workers at all stages of their careers. The previous paragraphs outlined potential strategies for stakeholders to facilitate skill and knowledge acquisition. Below, we highlight several additional strategies for the public sector to ensure access to opportunities for human capital acquisition across diverse population groups and throughout the lifecycle.

Incentives and supports to align education and training curricula with labor market needs. The approach to and content of skill and training education should be informed by and responsive to labor market needs. To facilitate this responsiveness, the National Science Foundation has several

Education and training institutions are often unable to respond to changing skill needs in local labor markets and nascent industries.

programs to foster collaborative relationships and information flows between STEM-focused industry and education and training providers. To help institutions develop programs for emerging technology fields that are experiencing a shortage of qualified workers, the Advanced Technological Education program supports materials development, professional development for instructors, and curricular development, while emphasizing the creation of pathways for two-year degree holders to obtain four-year credentials.⁸⁸ As another example, the Department of Labor's Education and Training Administration has offered grants to industry-education partnerships to support alignment between nascent industries with high-demand occupations and the development of training curricula. One such program, ShaleNET, was designed to address skill and worker shortages in the growing natural gas industry and create additional on-ramps to industry credentials (see Box 5). While care must be taken to avoid training for yesterday's job openings and over-alignment with any particular employer, close collaboration between a set of employers and education and training providers (often referred to as sector-based partnerships) can quickly stand up a qualified workforce and modify programs to accommodate evolving industry and technology requirements. Systematic integration and consultation of regional job growth metrics, as well as allowing real-time data to inform partnerships and program development, can mitigate the risks associated with industry-specific initiatives and decrease the number of unmatched workers.

Readily accessible information about education costs and returns. Exposure to career and technical education and education about career options in secondary schools, coupled with better measures of and research on credential costs and benefits, can improve individuals' access to information and decisionmaking. Research has shown that informational interventions can alter the matriculation patterns of low-income and first-generation college students.⁸⁹ However, deciding on the appropriate credentialing program is only part of the solution—equity requires both knowledge of and access to such opportunities.

Box 5. ShaleNET

ShaleNET was launched in 2010 to provide a training on-ramp to quickly growing careers in the natural gas industry in the Appalachian region.¹ In collaboration with local colleges, the Department of Labor, and industry partners, ShaleNET has helped more than 5,000 people receive training across four states, with almost 70 percent finding employment. ShaleNET has expanded to include a stackable credential program, allowing trainees to pursue a certificate, an associate's degree, or a bachelor's degree individually or sequentially. ShaleNET also includes a job-matching portal, which contains a listing of industry jobs, training requirements, and realistic job previews depicting both work environment and key responsibilities.

An ongoing evaluation by RAND is documenting how employers identify the knowledge, skills, and abilities required to perform successfully at their companies, and whether—and to what extent—they coordinate with public and private community colleges and training programs in the region to ensure that students are receiving the necessary training.² The study is also analyzing the content, utility, quality, and accuracy of ShaleNET curricula and using program participation data from the ShaleNET colleges alongside regional employment data. Through quasi-experimental statistical methods, RAND is estimating whether ShaleNET improves the employment outcomes for its students. The study is one of the first reviews of a sub-baccalaureate STEM workforce training curricula.

¹ ShaleNET, "About ShaleNET," webpage, undated.

² Gabriella C. Gonzalez, Christopher Joseph Doss, Julia H. Kaufman, and Robert Bozick, *How Educators and Employers Can Align Efforts to Fill Middle-Skills STEM Jobs*, Santa Monica, Calif.: RAND Corporation, RR-10053-NSF, 2019; Gabriella C. Gonzalez, Christopher Joseph Doss, Julia H. Kaufman, and Robert Bozick, *Supporting Middle-Skills STEM Workforce Development Analysis of Workplace Skills in Demand and Education Institutions' Curricular Offerings in the Oil and Gas Sector*, Santa Monica, Calif.: RAND Corporation, RR-2899-NSF, 2019.

Individuals' ability to make informed decisions about the costs and benefits of skill acquisition rests on the accuracy, completeness, and timeliness of informational systems. Those considering skill acquisition need to be well informed about the costs and potential returns from that skill in comparison with others, as well as the quality and placement record of relevant programs. Box 6 provides details about several initiatives around the world that enhance information flows about program costs and returns.

Innovative financing schemes, such as ISAs and value-based reimbursement, may perform double duty, aligning the financial incentives of education and training providers with student outcomes and reducing financial barriers to credential acquisition for students facing additional challenges. They also may help students internalize the costs and benefits of pursuing various credentials, as the payment terms are frequently determined based on major. Deferred, income-contingent public tuition programs (in use in Scotland, England, Wales, and Australia) function similarly to an ISA but are sponsored by the

government—a public-sector solution to increase the accessibility of further education and improve equity in opportunity.

Introspective evaluation of policy gaps and barriers. Policy can affect the ability of stakeholders to respond to market changes, as well as the accessibility of training opportunities and information about such opportunities. For example, policies surrounding state-issued certificates and licenses issued directly affect workforce opportunities and training pathways. States choose the eligibility requirements to sit for an occupational license, which occupations are licensed, and which states' licenses will be accepted without retesting. These policies make it more difficult for new entrants to these occupations but protect incumbent workers and potentially consumers of licensed services.⁹⁰

Box 7 describes an effort by the Annie E. Casey Foundation to implement systems-level reform in select cities by identifying policies that either promote or hinder entry into and matching within the local labor market. Funding tied to policies may be one of the most significant barriers and

Box 6. Performance-Based Rankings

Several countries use outcomes-based institution ranking to inform college applicants about graduation and employment prospects. In Singapore, the Ministry of Education's Graduate Employment Survey publishes employment rates (overall and full-time) and salary statistics (25th, 50th, and 75th percentiles, as well as the average) of publicly funded universities' alumni surveyed six months after graduation.¹ The information can be disaggregated from university data to school- or even program-level data and can also be stratified by honors graduation (e.g., cum laude). In Australia, the Good Education Group's Good Universities Guide and Good Careers Guide allows prospective students to search for careers, courses (majors and degree programs), and scholarships. The platform also provides rankings of both universities and courses by such metrics as graduate salary, full-time employment rate, teaching quality, and student retention.² There is also an overview of different types of tertiary study (postsecondary) institutions and available open online courses. The U.S. Education Department's College Scorecard provides some salary information at the institution level,³ and the American Institutes for Research's Launch My Career program⁴ provides return-on-investment information about projected earnings by institution and major for partner states.⁵ These resources likely decrease informational barriers for first-generation and nontraditional students, as well as those coming from a college-educated household.

¹ Singapore Ministry of Education, "Graduate Employment Survey—NTU, NUS, SIT, SMU, and SUTD," data.gov.sg, March 20, 2018.

² The Good Universities Guide, "Australian University Ratings and Rankings 2017/2018," webpage, 2018.

³ U.S. Department of Education, "College Scorecard," webpage, undated-a.

⁴ American Institutes for Research, "AIR Research Fuels 'Launch My Career,' a New Website to Help Students Envision Return on Investment for Higher Education Choices," press release, Denver, Colo., June 9, 2016.

⁵ Launch My Career Colorado, "Let's Find Your Best Course," webpage, undated.

opportunities for supporting workforce development programs. Funds are allocated through federal, state, and local sources and are distributed to individual governmental and institutional programs. Although a large amount of funds flows through this collection of programs, they generally do not coordinate services in ways that address learners' needs and disadvantages (e.g., job seekers who need both skill development and childcare services) or collaborate by sharing lessons learned (see Box 7).⁹¹ Therefore, funders of such programs at the federal and state levels could require a holistic view of workforce development that incorporates shared funding streams to provide the base-level services needed by job seekers. Also, including clauses attached to funding streams at the state level—similar to those implemented through WIOA and its predecessor acts (Workforce Investment Act and Job Training Partnership Act)—that require routine evaluation of the programs will enable funders to translate lessons learned to other similar programs. Finally, policymakers can consider more-foundational and

out-of-the-box policies, including reforming the secondary education system to not require a full four years to obtain a diploma or endowing each citizen with an "Education Security" account to be used to defray the costs of training throughout the lifecourse. In the next section, we discuss the Learning Agenda that will enable evaluation of current and future initiatives and foster a spirit of continuous innovation in the education and workforce development system.

Timely and Appropriate Matching and Re-Matching of Workers to Jobs

There are real and perceived skills gaps in the United States between employer needs and the employee talent pool, both among job seekers and veteran employees, that have been exacerbated since the Great Recession and the subsequent recovery.⁹² Across industries, some skill needs are growing, and others may be perceived as more in demand than they are in reality.⁹³ The pace and location of the growth in

Box 7. Identifying Policy Gaps: Jobs Initiative

The Annie E. Casey Foundation ran the Jobs Initiative—an effort to improve workforce training for young and disadvantaged job seekers—for eight years in six different cities.¹ By bringing together employers, local organizations, government representatives, and workers, the foundation was able to identify local, state, and federal policies that hinder or support workforce development. For instance, many state and local governments, as well as employers, do not build cultural competence training into workforce development planning, which inhibits the hiring and later success of employees who are traditionally disadvantaged. Also, policies that strictly regulate the ways that local governments can use federal and state funding for workforce development can limit a regional approach to targeted workforce training.² An evaluation of the program found that it was successful in placing workers in well-paying jobs.³

¹ Annie E. Casey Foundation, *Strengthening Workforce Policy: Applying the Lessons of the Jobs Initiative to Five Key Challenges*, Baltimore, Md., 2007; Annie E. Casey Foundation, “Jobs Initiative,” webpage, undated.

² Annie E. Casey Foundation, 2007.

³ Wendy Fleischer, *Extending Ladders: Findings from the Annie E. Casey Foundation’s Jobs Initiative*, Baltimore, Md.: Annie E. Casey Foundation, 2001.

need for skills are often unpredictable, which can be a challenge for structured education programs. Relying on historical skill needs is unsustainable in such a dynamically evolving marketplace, and current skill needs are often unknown or unpublicized. This skill mismatch occurs in both directions—some individuals are overqualified or overeducated for their position, and some are underqualified or undereducated for available jobs in their field. Others are skilled adequately for their current position but possess specialized skills in another field that they are unable to use in their current job.⁹⁴ Even when a skill match can be identified, other challenges and barriers, such as geographic limitations, lifestyle needs, and workplace preferences, may come into play that further limit opportunities for employers and job seekers to identify and obtain the best match. Therefore, efficient and timely job matching requires close collaboration between education and workforce systems (including employers) in close consultation with job seekers and the ability to foresee upcoming market changes and react quickly.

In the next sections, we outline some of the primary information gaps that exacerbate the mismatch of workers to jobs and possible opportunities to close those gaps. We also discuss the important considerations for the changing nature of work and its influence over individual job seekers

as they relate to wages and benefits, as well as policy impacts and implications.

Information Needs for Linking Workers and Employers

Improving information flow and streamlining the feedback loop among the key institutions in the workforce development and employment system could have profound effects on employers and employees being better matched. Currently, there are limited and isolated feedback loops between institutions and individuals, such as employers and trainers. Some instances of existing feedback loops include programs in which technical education providers work directly with businesses to minimize the information gap (e.g., ShaleNET in the United States, numerous programs in Germany and Switzerland) and the rising popularity of corporate educational institutions. For example, Walmart has opened its own schools to train young adults to work in retail. Other employers are focusing on “upskilling” their existing workforce by offering professional development and tuition assistance—examples of pathways from the labor market back to human capital (depicted in Figures 1 and 2). With these and other advancements in interconnection in mind, we now highlight emerging strategies and

potential features to support information flows and the matching of workers and jobs.

Robust connections between employers and education and training providers to align skill acquisition and skill needs. Informational sources about the needs of workplaces and availability of workers currently exist in various forms, such as job boards and social networks (e.g., LinkedIn) and skill development portals (e.g., LearnUp). Portals serve multiple purposes, including showcasing training opportunities for those with out-of-date skills (e.g., Germany’s Federal Employment Agency), allowing potential recruits to obtain and verifiably demonstrate skills (e.g., LearnUp), and highlighting regionally in-demand skills for educators and skilled potential recruits for employers (e.g., Skillful; see Box 8). Consistent with the goals of WIOA, state- and local-level Workforce Development Boards (WDBs), such as the Ohio Governor’s Office of Workforce Transformation and San Francisco’s Office of Economic and Workforce Development, are strategically aligning their workforce development efforts to employer needs and assisting workers with connecting to workplaces that match with their skills.

In a reimagined workforce development and employment system, technology could continue to provide opportunities for facilitating informational flow and perhaps training as needs arise, both from a worker’s current employer or educational institution

and from prospective employers and institutions. The system could move beyond passive sharing of information through posting on websites to active connections being made between institutions to align needs with skill acquisition. Automated updates could be programmed into information-sharing platforms that trigger alerts for employers’ human resources staff when new or current employees update their skills, training, or availability to match needs of the employer. Educational and training institutions could also integrate into the feedback loop and notify job seekers about opportunities to receive training that would position them for upcoming job postings. With a structured information flow from employers to education and training institutions about upcoming needs, institutions could reach potential employees with the chance to prime themselves for upcoming positions prior to the positions being posted. Similar feedback loops between employers and educational and training institutions must be implemented for these institutions to improve their practices based on employer feedback on their experiences with those they hired from the institution. WDBs may be able to play an integral role as an intermediary in the feedback loop; because of the localized nature of WDBs, some may already be serving in this capacity, whereas others may be able to improve their integration between all institutions

Box 8. Improving Information Flow Among Employers, Educators, and Job Seekers in Colorado

Skill-development portals have been popping up in numerous markets—regionally or nationally, for-profit or nonprofit, or for different populations. For instance, Germany’s Federal Employment Agency highlights training opportunities for those with out-of-date skills, and LearnUp is a for-profit company that allows potential recruits for the private sector to obtain and verifiably demonstrate skills. Another private skill development portal, Skillful, has had success to date; it was launched by Markle, Microsoft, LinkedIn, the State of Colorado, and other local Colorado partners. Skillful’s mission is to improve information flows among businesses, nonprofits, government, educators, and individuals in Colorado. The goal is to highlight regionally in-demand skills for educators, identify skilled potential recruits for employers, and improve access to career and training opportunities for job seekers. Skillful aspires to do this through behavior change—employers investing more time in skill-based job descriptions and hiring and individuals enrolling in more training. Although Skillful has not been formally evaluated, its reporting shows that 90 employers since March 2016 have signed on to shift toward skill-based employment, and 48 percent of individuals surveyed who are receiving support from Skillful have enrolled in training or obtained employment.¹

¹ Skillful, website, undated; Steve Lohr, “A New Kind of Tech Job Emphasizes Skills, Not a College Degree,” *New York Times*, June 28, 2017.

Although many public and private information-sharing platforms exist, they often only share information about job openings and prospective candidates rather than initiating a feedback loop among job seekers, employers, and educational and training institutions about the most sought-after skills.

at the regional level.⁹⁵ Although many public and private information-sharing platforms exist, they often only share information about job openings and prospective candidates rather than initiating a feedback loop among job seekers, employers, and educational and training institutions about the most sought-after skills.

Use of consistent, match-based hiring practices. Prospective employees face a confusing world of inconsistent terminology and non-standard skill and experience requirements. For example, at time of publication, a search for entry-level sales positions yielded assorted such job titles as “sales representative,” “marketing associate,” “account manager,” “telephone representative,” and “sales engineer.” These “entry-level” positions often require three to five years of experience, and many request a bachelor’s degree. Employers reviewing applications may only be able to infer or guess whether applicants have skills—good teamwork skills, be deadline-oriented, have an entrepreneurial mentality, or possess excellent people skills that would positively contribute to the goals of the position. With such a variety of job titles and descriptions for positions that require similar skill sets, job seekers struggle to articulate their qualifications in a format that potential employers would respond to, particularly pronounced among those from disadvantaged backgrounds.⁹⁶ Consistency in job postings that emphasize the precise skills needed and goals of the position would help (1) job seekers position

themselves to be hired, (2) employers identify candidates who are best matched, and (3) educational and training institutions better prepare their students, potentially improving both equity and efficiency.

Greater employer and industry awareness of forecasted workforce needs and skills. Before an employer could begin to improve information flows or match-based hiring practices, it must first understand its workforce needs. Historical trends may not be valid predictors for the future; therefore, employers could forecast their needs in terms of the number of employees they would require over the short and long terms, the skills those employees must possess based on firm or industry trends, the likely supply of worker availability, the costs of hiring and supporting all of the workers needed, and the likely retention rate of employees over time. A reimagined system could incorporate newly developed supply and demand models for firms and industries to help fulfill this need. The U.S. Army, for example, built such a model to predict civilian workforce needs (see Box 9). A firm-specific forecast, such as the one described for the Army, differs from an industry-level forecast (e.g., occupation forecasts by the BLS). Firm-level forecasts could be most beneficial for large employers, whereas workers and students may benefit more from reviewing industry-level forecasts. Once firms and industries predict their upcoming needs, this information can be transmitted to educational and training institutions

Box 9. Using U.S. Army Modeling to Predict Workforce Needs

The U.S. Army depends on a civilian workforce to support the deployable forces. To support the Army in appropriately sizing this segment of its workforce, RAND developed separate workforce supply-and-demand projection models. The supply model, or the RAND Inventory Model, was disaggregated by different command and occupation groups and predicted the total civilian Army workforce for future fiscal years. The demand model, or the RAND Generating Force-to-Operator, analyzed predicted budgets and activities to be carried out by the civilian workforce. These combined models assisted the Army with determining how many people to hire under a variety of different scenarios. The models helped to estimate costs for hiring and supporting the civilian workforce.¹ Many other industries could implement a similar model to project future supply and demand, as well as cost of their workforce. If other major industries (e.g., manufacturing, construction, technology) could better predict and communicate the needs of their sectors based on their predicted costs, educational and training institutions could better prepare students to enter the workforce with the skills needed to match employer needs.

¹ Shanthi Nataraj, Lawrence M. Hanser, Frank Camm, and Jessica Yeats, *The Future of the Army's Civilian Workforce Comparing Projected Inventory with Anticipated Requirements and Estimating Cost Under Different Personnel Policies*, Santa Monica, Calif.: RAND Corporation, RR-576-A, 2014.

(both K–12 and postsecondary), and the institutions can work collaboratively to determine how to best prepare current and future workers for needs: formal education, training, or firm-level OJT. Educational and training institutions could then redesign their curricula to best meet future needs of employers and industries, which would help provide their students with the best chance to secure a position postgraduation or certification, and firms can develop OJT that matches the projected skill needs. Workers and students preparing for future study can also use this information to make better-informed choices about their career paths.

Mechanisms for monitoring downstream education and training outcomes. Electronic health records (EHRs), or digitized versions of individuals' health records, have increased in use in the health care sector.⁹⁷ Implementing EHRs has been found to improve efficiency in medical care and support meaningful data sharing among different health care providers.⁹⁸ The workforce development and employment system could implement a similar electronic concept—an electronic education and training record (EETR)—to improve information flows in the workforce development system. An EETR could track the education and training record of an

individual from early childhood through retirement. Such a record could virtually showcase all of the skills an individual has formally gained through education and training. It would also help employers identify the skills that a potential employee or current employee seeking a promotion would need to acquire, enabling new synergies between employers and educational institutions. From a system-level perspective, EETRs would also facilitate new diagnostics and improved resource coordination for individuals who are unemployed or underemployed, allowing researchers to highlight what skills are in demand and associated with favorable outcomes.

Although implementation concerns about privacy and misrepresentation would need to be addressed, an EETR could prove to be a compelling strategy for improved information flows between education and labor market subsystems. A similar concept was banned in 2008 by the federal government during the reauthorization of the Higher Education Act; it was determined then that colleges cannot report data at the student level.⁹⁹ A bipartisan bill to overturn this policy was introduced in 2017,¹⁰⁰ generating new momentum in the debate over tracking the graduation and employment outcomes of higher-education students.¹⁰¹

Features of Jobs: Wages, Compensation, Career Trajectories

Recent labor market changes have been shifting several risks from firms onto workers. In the 20th-century model, many workers were employed by an employer that provided access to group health insurance, retirement income security through a defined benefit plan, at least a partial insulation against shifts in demand and the business cycle, and opportunities for professional development and advancement. Today, in contrast, employers are less likely to provide workers with benefits, particularly pensions.¹⁰² Also, workers are increasingly mobile, and the rise of “work intermediation platforms” (e.g., Uber, Lyft, TaskRabbit, Etsy) has created flexible hours for workers but deprives them of access to shared benefits and risk-pooling, as “coworkers” are increasingly disconnected.

Where workers do receive benefits, these can tie workers to particular jobs, limiting mobility. Lapses in health insurance coverage, loss of paid time off and leave benefits, and reductions in retirement benefits are all fears that may cause an employee to remain with an employer longer than what is otherwise socially efficient, a phenomenon known as “job lock,”¹⁰³ and geographic immobility has also been tied to depressed wages.¹⁰⁴

The changes in the nature of employment, in addition to more-traditional factors that interrupt labor market participation (e.g., parental or caregiver leave), result in a greater variety of career trajectories. These changes increase the importance of information flows and worker mobility as workers match and rematch throughout their careers. Next, we outline a few private-sector strategies to support efficient matching through mobility.

Structures for reaping the rewards of investing in employees. Turnover and training are costly, so many employers carefully screen individuals for potential and longevity and often seek to avoid training costs by hiring individuals already capable of performing the requisite tasks. Employers could instead focus on hiring from within and providing supplemental training specifically geared toward career progression within the organization rather than looking to the external labor market for

Recent labor market changes have been shifting several risks from firms onto workers.

job seekers who already possess the skills for the position. Employers are often reluctant to invest in potentially transferrable skills, however, which deprives employees of high-quality professional development. The information age has made employees today increasingly aware of alternative employment opportunities and the value of credentials to competing employers, increasing the financial risk to employers providing training. To combat this possibility, some employers’ private tuition–reimbursement policies contain provisions stipulating that if the employee leaves the company within a short time frame, he or she must repay a prorated percentage of the tuition. This could decrease some of the moral hazard risks for the employer while still enabling workers to grow professionally.

New mechanisms to meet the needs of the growing gig economy. Many people are increasingly turning to freelance positions through the gig economy when they are unable to find traditional employment. Independent contractors and other temporary workers make up an increasing fraction of the workforce, although the exact proportion is sensitive to both the definition and the sample used.¹⁰⁵ More than one-quarter of the gig economy’s participants are in these alternative work arrangements out of necessity, not by choice.¹⁰⁶ In Australia, 18 percent of young adults stitch together multiple part-time jobs to sustain full-time hours, and 21 percent are in casual full-time employment that provides no security or benefits.¹⁰⁷ Gig-economy workers bear responsibility for securing their own health care, do not receive paid time off, must make and manage contributions for retirement, and need to continually search for new gigs to remain employed

Researchers have observed a dramatic decline in matching efficiency during and after the Great Recession.

full-time throughout the year. They generally lack access to such protections as unemployment insurance and workers' compensation.¹⁰⁸ One solution, building from the guild model in some occupations (e.g., Screen Actors' Guild), is for worker collectives to form tied to the types of work individuals engage in rather than tied to a particular employer. Associations such as the Freelancers' Union provide access to lower-cost group-based health insurance and other benefits, as well as professional networking. However, these associations require either initialization from the employer or the ability for coworking contingent workers to find one another and organize. Where workers are unable to organize, policy actions, such as portable benefits as discussed in Box 11, may also act as critical levers for adapting the system.

Policy Implications Surrounding Efficient Matching

Researchers have observed a dramatic decline in matching efficiency during and after the Great Recession.¹⁰⁹ They find that while much of the variation in matching efficiency before 2006 was driven by who was unemployed (their respective employability and unemployment duration), more-recent fluctuations are driven primarily by occupational and geographic dispersion and are not industry-specific. Thus, one key to facilitating efficient matching is ensuring the mobility of workers across jobs, careers or occupations, and geographies. However, mobility is an effective support only

in the presence of free exchange of information, where employers and employees are well informed about one another's characteristics and alternative opportunities.

In the previous section, we identified several obstacles to efficient matching. First, employers and prospective employees or students often face substantial costs associated with acquiring better information (about opportunities and match quality) required for informed decisionmaking. Workers cannot move to jobs they do not know about, and employers cannot hire employees they cannot evaluate. Second, wage and benefit structures create frictions for employees hoping to change jobs. Third, geography ties employees to local employers, with relocation's explicit and implicit costs proving prohibitive for some. Public policies, as well as policies on the part of employers and other private stakeholders, have the potential to address these issues.

Improving Information Flows

Mechanisms to reduce employer costs of exploring match quality. Matching is a two-sided problem, and employers are reluctant to hire workers who are likely to leave or require substantial training. Employers can access subsidies for hiring certain classes of workers (e.g., veterans, former felons, welfare recipients) through the Work Opportunity Tax Credit.¹¹⁰ This tax credit, effectively an employment subsidy, has been shown to have beneficial short-term impacts and negligible long-term impacts.¹¹¹ Another mechanism to facilitate hiring is to encourage graduated wages. The Fair Labor Standards Act allows employers to pay young adults a subminimum "training wage" for the first 90 days of employment (see Box 10).¹¹² This decreases the cost and risk of hiring a worker who is potentially underqualified, facilitating a "try-out" period that also improves both an employer's and an employee's information about the match quality. This policy also reinforces the idea that employees can be paid in proportion to the amount of skill or experience they have rather than the skill amount being a prerequisite for employment. Federal subminimum wage policies may incentivize industries to pay these learners, with the return to

Box 10. Subminimum Training Wages

The Fair Labor Standards Act authorizes employers to pay subminimum training wages to youth under 20 years of age during the first 90 calendar days of employment.¹ In Puerto Rico, Section 403 of the Puerto Rico Oversight, Management, and Economic Stability Act expands the eligible population to employees under the age of 25.² This decreases the costs and risks of hiring underqualified workers and may encourage employers to not only hire more workers but also hire workers who appear trainable but currently lack the formal qualifications to do the job. A culture of training wages could extend beyond low-wage work—employers could “try out” salaried workers for short periods of time with reduced cost and reduced risk, creating more on-ramps to employment for trainable but underqualified potential workers.

¹ U.S. Department of Labor, “Fact Sheet #32: Youth Minimum Wage—Fair Labor Standards Act,” July 2008.

² U.S. Department of Labor, “Fact Sheet: Impact of the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA) for Employees in Puerto Rico,” October 2016.

employers being an engaged potential workforce in the future. Employers could also collaborate with educational and training institutions to employ students for a set period of time to give students real-world experience and employers the chance to recruit the highest-quality candidates with minimal risk (see Box 11).

Employers may also be able to invest in the workforce development of youth in a way that is productive and informative for the employers and safe and educational for young people. The federal minimum age to enter the workforce is 14 for non-agriculture work, and, until 16, the number of hours a minor can work is limited. Many states have additional limitations.¹¹³ Creating pathways for younger people to gain a more thorough understanding of their career options may improve matching later in life, as they are choosing education and training pathways into their jobs and careers. These pathways could come in the form of curriculum designed in partnership with industries, regular classroom activities with companies, or even work experience time with students in higher grades where students are given leave from the classroom for a certain amount of time to engage in paid or nonpaid job-shadowing activities. Federal and state policies may need to be reviewed to refine the definition of what constitutes work when giving youth job-shadowing opportunities, particularly paid ones.

Access to information on industry and occupational trends. The BLS already tracks and forecasts occupational and industry growth.

However, employers would benefit from localized metrics that would allow them to anticipate hiring shortfalls and collaborate with regional workforce development organizations to attract qualified workers. The BLS could also track and monitor the demographics of the hiring pool in comparison with the characteristics of those who were hired. With this information, incentives can be refined to either recruit a more diverse applicant pool or hire candidates that the government is motivated to mobilize into employment. Regional workforce development organizations and education and training institutions could also track applicant pools against hiring practices and provide programs to better prepare subgroups of job candidates that are routinely being left behind.

Use of standardized language describing and measuring skills and positions. Just as the Food and Drug Administration regulates the definition and usage of such terms as *low-fat* and issues industry guidance about other labeling practices, the Department of Labor could standardize language about skills and job attributes. For example, the term “entry-level” job might be applied only to job openings where candidates with no experience would be considered. Where possible, consistent measures of such skills and attributes as “ability to multitask,” “detail-oriented,” and “team player” should be developed, and position score requirements could be incorporated into the job posting. Such standardization could be implemented at the industry level or by intermediaries (e.g., Indeed,

Box 11. Portable Benefits

Washington state legislators are considering portable benefits legislation¹ that would ensure consistent provision of workers' compensation across jobs and creates the infrastructure for an employee to contribute to other potentially portable benefits, such as health insurance, paid time off, and retirement savings.² The bills also streamline the classification of independent contractors, potentially extending workplace benefits to more employees. This legislation may encourage more workers and nonworkers to enter the informal labor force, and it also defrays some of the side risks from the employee changing jobs, potentially increasing worker mobility and increasing the competitiveness of the market for labor. Washington is not alone in this movement—similar bills or committees have been discussed or enacted in California,³ New York,⁴ and New Jersey,⁵ and even federally.⁶ The federal bill, for example, would also require research on wages and tax compliance.⁷

¹ Washington State Legislature, HB 2109–2017–18, Creating Portable, Prorated, Universal Benefits for Workers of the Gig Economy; Washington State Legislature, HB 2812–2017–18, Concerning Determinations of Worker Benefits and Employer Obligations Based on a Worker's Status.

² Robert Maxim and Mark Muro, "Rethinking Worker Benefits for an Economy in Flux," Brookings.edu, March 30, 2018.

³ California Legislative Information, "AB-2765: Employment Benefits: Digital Marketplace: Contractor Benefits," March 23, 2018.

⁴ New York State Assembly, "SB 6355 Summary," May 11, 2017.

⁵ New Jersey State Legislature, Assembly Bill 3824, April 12, 2018.

⁶ U.S. Congress, 115th Cong., 2nd Sess., "Treasury Gig Economy Tax Study," June 20, 2018; Alastair Fitzpayne and Hilary Greenberg, "Portable Benefits Legislation Reintroduced in Washington State: Uber and SEIU Commit to Work Together," Aspen Institute, February 23, 2018; Mark R. Warner, "Sen. Warner Announces Growing Support for Portable Benefits Legislation," June 20, 2018.

⁷ Warner, 2018.

LinkedIn). Although the credentialing process could satisfy this need for some occupations, increased standardization could help both job seekers and employers in occupations that do not require specific credentials.

Employers and employees alike would benefit from a standardized screening of prospective employees by a job application platform. The platform could put applicants through structured scenarios designed to measure soft skills and then pass ratings on to employers. There are several small platforms focusing on talent screening, but these platforms are isolated from one another, are frequently individual employer-driven, and rarely incorporate soft skills and competencies.¹¹⁴ A notable exception is pymetrics, which uses games to rank candidates with common metrics and a common application across employers, allowing candidates who are poorly matched with one employer to seek better-fitting opportunities.¹¹⁵ This platform also allows employers to have current successful employees take the screener to algorithmically determine which skills are most relevant and apply those criteria to applicants. Public investment in

a broader, no-fee toolkit for describing skills and attributes could help standardize language and measurement of job-relevant qualities, improving information flow between employers and prospective employees (particularly those from disadvantaged backgrounds). It would also enable analysis of these standardized skill measures by training institution, providing valuable feedback to institutions and prospective students.

Supporting Job Mobility Through Public Policy

Mechanisms to make benefits transferable across employers. While there has been extensive exploration of portable benefits for independent and contract workers (see Box 11), far fewer resources have been devoted to determining how to ensure continuous access to benefits for employees who are changing jobs. Currently, retirement benefits such as 401(k) plans can be rolled over into an Individual Retirement Account or another employer-sponsored retirement plan. The same cannot be said of health insurance—individuals with a lapse in employer-sponsored coverage are often eligible for

Greater worker mobility may increase turnover, increasing costs for employers. As an alternative to losing employees because of geographic relocations, employers may consider increasing the ability for employees to telecommute.

Consolidated Omnibus Budget Reconciliation Act (COBRA) coverage to extend their previous plan. However, this benefit is not extended to those losing education-based coverage (i.e., graduating students), and COBRA coverage is generally very expensive. This is not to say that benefits should be entirely divorced from employment—offering generous leave policies or good health coverage is an important mechanism for employers to differentiate themselves when competing for employees with different preferences. Alternatively, employers could create flexible benefit plans, where permitted by state labor laws and subject to Affordable Care Act affordability provisions, that account for the heterogeneity in employee priorities and preferences that could permit employees to, for example, elect all benefits to be compensated as wages instead.

Access to telecommuting to decrease the geographic ties of jobs. Greater worker mobility may increase turnover, increasing costs for employers. As an alternative to losing employees because of geographic relocations, employers may consider increasing the ability for employees to telecommute. Telecommuting has more than doubled since 2000, and those who telecommute out-earn those who live in the same area (which may reflect the types of jobs conducive to telecommuting).¹¹⁶ In some U.S. cities, telecommuting constitutes the plurality of commuting methods, outranking personal vehicles and public transit. While the option to telecommute is ultimately dependent on the nature of the job and its related tasks or on employer policy, state and local governments can facilitate telecommuting by investing in high-speed internet access, ensuring that

urban and rural residents alike have the capacity to telecommute effectively.

Options to defray the costs of job-based relocation. The Internal Revenue Service allows taxpayers to deduct moving expenses related to a job relocation (within or between employers).¹¹⁷ Unfortunately, booming labor markets generally correlate with higher costs of living, and the upfront costs of moving are substantial. Researchers have noted a decline in working-age internal migration within the United States,¹¹⁸ arguing that the immobility resulting from housing constraints has had a significant negative effect on U.S. economic growth.¹¹⁹ One-time grants to help defray startup and moving costs could enable workers to move to regions with better job prospects (wages, openings) that compensate for their higher costs of living. These grants could be run as an extension of the unemployment insurance program and would help those who receive other public benefits cover any lapses in receipt caused by migration.¹²⁰ The grants could focus on towns outside of large metropolises with the highest need for workers to encourage the spread of workers from already crowded localities.

A system that flexibly supports matching and rematching, as well as time between matches. Throughout the lifecycle, workers will face a multitude of events that may alter their career trajectories, such as taking parental or short- or long-term disability leave, having a change in health status, spending time in prison, or taking time out of the workforce to pursue education or training. Others may take an early retirement and then need to reenter the workforce in a new career; a survey by AARP found that 13 percent of

retirees continue to work in different capacities.¹²¹ These individuals often face a series of additional challenges in acquiring and retaining employment and may not receive the training needed to overcome gaps in their work history. While the gig economy may serve as a temporary or permanent option for workers facing such challenges, it may not be a reliable avenue for optimizing skill matching. Such protections as universal basic income (UBI)—providing citizens with a basic sum of money on a regular basis—could increase job mobility and more-optimal skill matching, not only decoupling benefits from employers but also decoupling employment and income, which reduces risks from voluntary and involuntary changes in employment status over the lifecycle. UBI could also allow employees to take more risks in changing jobs and seeking new opportunities to develop human capital while out of the workforce. Although Finland and many cities around the world (including Stockton, California) have experimented with UBI,¹²² its effect is still relatively unknown,¹²³ and studies show that it may be highly variable by location and by implementation.¹²⁴

The Need for a Learning Agenda to Advance Research and Policy Analysis of the Systems Approach

A workforce development and employment system governed by data was one of the desirable system features we identified earlier. An evidence-based system would support *monitoring* the inputs, outputs, and outcomes of the current system; *identifying* where the system is failing to meet its objectives and therefore in need of reform; *developing and testing* various interventions or policy changes and *measuring* their impact; *disseminating* information about what does and does not work; and *scaling up* proven remedies with fidelity. In sum, there is a need for a data-driven research and policy agenda that will advance our understanding of the current system—both its flaws and its successes—while working toward a self-governing system that is more efficient and effective.

In support of that agenda, we see the need for relevant metrics to track system processes and outcomes; sources of data to measure the desired indicators (some measured at the individual level); tools to support the design of innovative solutions to existing system shortfalls; incentives to implement and evaluate real-world pilot studies that deploy potential solutions and rigorously evaluate their effectiveness; and mechanisms to synthesize the available evidence, draw broader lessons for further refinement of intervention models, scale up proven approaches, and disseminate findings to key stakeholders. We address these needs in this section.

Metrics and Data Sources

A system-level perspective of the workforce development and employment system provides a framework for identifying indicators that will capture system processes and outcomes. At the highest level, metrics would indicate whether the system was achieving its goals of equitable access to opportunities for skill development and timely and appropriate matching of workers to jobs (see Table 1 for illustrative indicators). Other indicators would focus more specifically on components of the system, such as different stakeholders. These would include, for example, measures of the specific skills and credentials that individuals have acquired that are valued in the labor market, individual access to information and their knowledge about labor market needs, investments that employers are making in their employees through education and training programs, and the processes and outputs of the education and training sector. Where appropriate, it would be possible to examine differences in the indicators for subgroups defined by demographic characteristics (e.g., gender, age, race, ethnicity), socioeconomic status, geography, occupation, and industry. Measures would also track the specific policies relevant to the system that are in place at a given point in time at the national, state, and local levels.

Various federal agencies, such as the U.S. Bureau of the Census, U.S. Department of Education, and U.S. Department of Labor, as well as equivalent state-level agencies, already provide important

Table 1. Illustrative Indicators and Data Sources

System Goal	Indicator	Metrics	Data Sources	Stratifications						
				Demographics	Education	Socioeconomic status	Geography	Industry	Occupation	
Equity	Awareness of opportunities	Knowledge of career pathways, educational requirements, funding options	Household and individual surveys, particularly young adults	X	X	X	X			
	Access to developmental opportunities	Application, matriculation, completion	Administrative data from educational institutions, survey of individuals	X	X	X	X	X	X	X
	Access to skill and career ladders	Change in position, change in earnings, ease of reentry	Tax data, household and individual surveys	X	X	X	X	X	X	X
Efficiency (timely and appropriate)	Specialized education utilized	Completion rates, debt loads, gainful skill-appropriate employment	Administrative data from educational institutions, loan repayment data linked to employment outcomes, survey of individuals	X	X	X	X	X	X	X
	Few vacancies, limited quick turnover	Days job posting open, tenure of new hires	Administrative data, survey of employers					X	X	X
	Appropriate matches	Under-/over-qualification, workplace preferences	Survey of employees, survey of working conditions, employee data coupled with occupational requirements	X	X	X	X	X	X	X
	Enduring matches	Tenure of hires vs. training costs	Survey of employers, employees	X	X	X	X	X	X	X
	Worker agility	Length of time unemployed or underemployed	Survey of individuals	X	X	X	X	X	X	X
	System agility	Anticipation of hiring needs, alignment of training programs	Survey of employers, qualitative survey of program offerings						X	

NOTE: Light purple shading indicates the suggested stratifications for each metric's data collection and analysis.

statistical information relevant for understanding the workforce development and employment system by drawing on administrative data and deploying various surveys. Even so, there are opportunities to fill gaps in the data needed to capture the desired indicators, provide more real-time information, and support the evaluation of reforms (see Table 1). The growing use of integrated administrative data systems supports the ability to view the interrelationships in processes and outcomes across different systems in the public sector, but further progress is needed. For example, the Data Quality

Campaign reported that, as of 2014, only 19 states had linked their K–12 data system with data from early learning, postsecondary education, and the labor market (e.g., employment and earnings).¹²⁵ Moreover, such state-level data systems are limited in their ability to look across state lines. Further, while great strides have been made in linking data systems in the public sector, it remains challenging to bridge data across the public and private sectors (e.g., data on employer's skill needs, hiring practices, and fringe benefits).

In the arena of survey data, longitudinal data sets, such as the Survey of Income and Program Participation, the National Longitudinal Surveys of Youth, and the Panel Study of Income Dynamics, provide researchers with the opportunity to examine patterns in human capital formation and labor market participation over the lifecourse. However, these panels lack the ability to quickly build evidence in emerging areas, as the panels are fielded according to a set schedule. The use of internet panels, such as the RAND American Life Panel and the RAND American Educator Panels, have reduced the cost of collecting high-quality data for nationally representative samples with rapid turnaround times when collecting data at each wave. Such panel data also provide the ability to link responses to survey questions through time in multiple domains, including education, training, and the labor market.¹²⁶ The internet panel data approach could be applied to build representative samples of other informants of interest, such as displaced or unemployed workers, veterans, persons with disabilities, K–12 superintendents, college or university leaders, training program directors, human resource professionals, and union leaders.

Piloting new interventions or policies can contribute to the understanding of what works—and for whom—in advance of making a larger-scale investment or policy change.

Designing, Testing, and Evaluating Reforms

While metrics and data may provide identification of failings in the current system, it can be challenging to design new approaches that will be more effective. The workforce development and employment system is tremendously complex, and we typically have incomplete knowledge about the factors that drive decisionmaking and the relative importance of each factor. Despite this incomplete knowledge, very little money is spent on education research and development (R&D) that might unearth more interventions and insights, particularly when compared with R&D investment in other rapidly changing sectors.¹²⁷

Given the time that it takes to try new approaches and determine whether they work, it is important to use all available methods to increase the likelihood that new approaches will be as effective as possible. This means drawing on past evidence of what did and did not work; considering underlying theories of the dynamics of decisionmaking at the individual, organization, and system levels; and exploiting other tools that can aid in program and policy design. For example, RAND has a long history of using analytic gaming to improve decisionmaking in an array of policy areas, including education (see Box 12). Using gaming provides an opportunity to gather diverse stakeholders together in the workforce development system to explore pressing issues through scenario-based activities. It provides an opportunity to explore a simulation of real world-based team, which could help open doors for enhanced partnerships and innovative solutions to ingrained challenges. Likewise, insights from the field of behavioral science are being used to test out policy changes in a variety of domains, including the education system, labor market, and social services.¹²⁸

Piloting new interventions or policies can contribute to the understanding of what works—and for whom—in advance of making a larger-scale investment or policy change. Pilot studies (also called *demonstration studies*) ideally examine the process of implementation to determine whether the intended model or reform is put in place and whether there are barriers to operating with fidelity.

Box 12. Applying Gaming to Education Policy

As an analytic tool, gaming can be used in various ways depending on the objective. It can assist with problem formulation, help identify hypotheses to test, and support hands-on testing of designs or strategies to address a problem. Games can bring together stakeholders to interact in new ways, spark fresh thinking, and bring to light issues and solutions that would not have otherwise emerged. The RAND Center for Gaming supports the application of games to various policy areas.¹ For example, education researchers at RAND are developing a policy game to explore the use of public funds to support private-operated voucher and charter schools. The debate about these policies engenders strong views by opponents and proponents who have limited information about each other's underlying motivations and priorities. The game will shed light on the beliefs held by competing groups and the trade-offs they are willing to consider.

¹ RAND Corporation, "Methods Center: Center for Gaming," webpage, undated.

Such studies can also be a source of information about the cost of the intervention or policy change, both for start-up and on an ongoing basis. They also lend themselves to a variety of robust evaluation methods, such as randomized controlled trials, which can help measure the true effect of an intervention, including intended and unintended outcomes. Because experimental studies are not always feasible, evaluators can rely on a number of rigorous quasi-experimental designs that support a high level of confidence in the measured effects. Further, reliance on administrative data sources can lower the cost of evaluation and permit rapid-cycle evaluations that test small changes in processes, information dissemination, and incentives to improve the functioning of specific components of the system. Replication of pilot or demonstration studies in multiple sites or with varied target populations further strengthens the evidence of effectiveness.

Given that evaluation is costly, it is important that funders in the public and private sectors include resources for rigorous formative and summative evaluation of interventions and policy reforms. In a number of areas of federal policy (e.g., early childhood home visiting, K–12 education, teen pregnancy prevention, employment and training programs), some funding is now contingent on implementing proven programs that meet minimum criteria for evidence quality.¹²⁹ Where new program models are proposed that do not have supporting evidence, implementation must be accompanied by rigorous evaluation that contributes to the knowledge

base. To raise the profile of policy challenges and to incentivize rigorous evaluation of the potential solutions, there is also promise in the use of prize competitions to make head-to-head comparisons of alternative approaches in real time (see Box 13). This strategy is viewed as especially relevant for unsolved individual-level problems with clearly measurable outcomes and potential solutions that are well-defined, with many potential competitors, and evaluable in a short time frame (e.g., one to three years). Although it may not be feasible for governments to fund such competitions, private philanthropies focused on improving the functioning of the workforce development and employment system may be in a good position to encourage experimentation and provide the needed financing to operate the competition.

Learning from the Evidence

With the growth of proven interventions and policy changes to improve the functioning of the workforce development and employment system, it is vital that decisionmakers in the public and private sectors—from policymakers at the national level to practitioners at the local level—have access to the available findings and the implications for policy and practice. The information that could be of interest is scattered across academic journals, reports by research centers and think tanks, and articles in specialized outlets that serve specific audiences, such as specific industries, occupation

Box 13. College Success Prize

In 2014, the Robin Hood Foundation launched the College Success Prize to spur the development of “an innovative, scalable, and technology-enabled tool” that would increase the rate of degree completion on the part of community college students in New York City. The structure of the College Success Prize competition itself was designed by Ideas42, a behavioral design lab, and the insights from behavioral science were used to further strengthen the intervention models of the two finalist teams selected for the competition on the basis of their initial design. Each of the designs is being evaluated using a randomized controlled trial with first-time students in need of remedial courses at the City University of New York who enrolled in fall 2015. Success will be judged by the impact on three-year graduation rates, with a prize up to \$5 million awarded to the winning organization.¹ Finalist programs are currently under evaluation by Abt Associates.²

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² Abt Associates, “Promoting Persistence in Community College Students,” webpage, 2019.

groups, and worker associations. Although the main interest may be in the policies and interventions implemented and tested in the United States, a lot can be learned from models begun in other countries and that could be applied in the U.S. context. Thus, if the evidence is being used effectively to inform decisions, it is essential to reduce the cost of accessing the information, provide objective judgment about the quality of the information, and communicate the content in accessible and digestible formats.

A first step is to systematically assemble the available information, evaluate the quality of the evidence, and synthesize the findings, recognizing the potential for variation in the effectiveness of different programs and policies depending on the population served and the context of implementation. Further, because the evidence base is constantly expanding with longer-term follow-up of earlier studies and initial findings from new studies, an ongoing process is required. The What Works Clearinghouse, funded by the U.S. Department of Education, has provided access to evidence in early childhood and K–12 education policy and practice for diverse stakeholders for nearly two decades.¹³⁰ Likewise, the U.S. Department of Labor’s Clearinghouse for Labor Evaluation Research provides a repository of research on formative and summative studies of labor market programs and policies.¹³¹ Extending these resources to the broader workforce development and employment system would be a valuable source of information

for decisionmakers in the public and private sectors focused on advancing the system.

Moving from a Reimagining into a Revised System

Like in earlier decades, the past several have seen dramatic changes in employer skill demands, educational patterns, and job trajectories. However, these changes are occurring at an unprecedented pace, necessitating structural changes in the U.S. workforce development and employment system to create a self-monitoring and self-governing system that can keep up. Furthermore, these changes disproportionately affect particular segments of the workforce and society. We first presented contrasting depictions of the 20th- and 21st-century workforce development and employment systems, noting that the modern systems’ nonlinearities in education, training, and employment necessitate a holistic “systems” perspective in approaching reform.

A reimagined workforce development and employment system has the potential to transform human capital acquisition for workers by promoting more agile and responsive means for matching and rematching workers based on current or future skills. We suggest several promising strategies and system features to improve equity in informational and financial access to human capital development opportunities, and we also enumerate strategies and features that can improve the speed and quality of

employee-employer matching. However, the evidence basis for such strategies and features is limited to piecemeal evaluation; system-wide reform requires system-wide insight. These proposed approaches are based on preliminary evidence from pilots or research theory. Despite their grounding in evidence, revisions to the current system based on this reimagined concept should be continually adapted based on data and a growing evidence base that accounts for contextual factors and functions at scale. Additional conversations regarding the implementers of the strategies must be discussed, although the

institutions discussed in this report and federal, state, local, and private policymakers will each play a critical role as systemic changes unfold.

The contribution of this work is to put forth one potential vision for the future workforce development and employment system and to establish an ambitious agenda to form a more complete evidence basis, identifying indicators, metrics, and potential data sources to measure the system's success in promoting equity and efficiency and discussing how to ensure that stakeholders and decisionmakers have access to high-quality, actionable evidence.

Notes

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About This Report

Despite nearly entering the third decade of the 21st century, the U.S. approach to education, training, and workforce development still largely operates on a 20th-century model. Workforce preparation—a linear pipeline from K–12 education to possibly college and then a job—looks similar to how it did several decades ago.

Recognizing the value of interdisciplinary collaboration and systems thinking, RAND Corporation researchers developed a systems-level, blue-sky approach to conceptualizing and visualizing a 21st-century U.S. workforce development and employment system. This report is the first step toward moving the United States to a system that accounts for workers' needs for lifelong learning, employers' continuously changing workforce requirements, rapid and often disruptive changes in technology, and the ever-evolving nature of work. This publication should be of interest to educators, business leaders, policymakers, researchers, and other stakeholders who are engaged in issues relating to workforce education and training and the future of work.

About RAND Education and Labor

This study was undertaken by RAND Education and Labor, a division of the RAND Corporation that conducts research on early childhood through postsecondary education programs, workforce development, and programs and policies affecting workers, entrepreneurship, financial literacy, and decisionmaking.

More information about RAND can be found at www.rand.org. Questions about this report should be directed to karoly@rand.org, and questions about RAND Education and Labor should be directed to educationandlabor@rand.org.

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