

A close-up, profile view of a man with a beard wearing a white hard hat and a high-visibility yellow safety vest over a plaid shirt. He is looking down at a white smartphone held in his right hand. The background is blurred, showing an industrial or construction setting with warm lighting.

Swiping Right for the Job

How Tech is
Changing
“Matching” in
the Workforce

NEW SKILLS AT WORK

JPMORGAN CHASE & CO.

Around the world, employers, educators, policymakers, training organizations, and others have recognized the critical importance of tackling the skills gap. Through our \$250 million, five-year New Skills at Work initiative, JPMorgan Chase & Co. is using our resources, expertise, and global reach to help inform and accelerate demand-driven skills training. Launched in 2013, New Skills at Work is providing data-driven analyses, engaging employers in sector partnerships, and supporting training programs that are aligned with local demand. Visit www.jpmorganchase.com/skillsatwork to sign up for updates on our programs.

FREEDMAN CONSULTING, LLC

A report by Freedman Consulting, LLC, with support from JPMorgan Chase & Co. Freedman Consulting, LLC, a consulting firm located in Washington, D.C., provides high-level strategic consulting, communications planning, and policy development on a broad portfolio of issues focused on innovations for the greater social good. Building upon diverse experience in politics, policy, communications, high-level marketing, and philanthropy, the firm advises a wide range of clients, including major foundations, elected officials, non-profit organizations, political campaigns, and corporate philanthropy.

Table of Contents

2

Part I

Introduction

6

Part II

Types of Labor Market Matching Technology

20

Part III

User Interactions with Labor Market Matching Technologies

30

Part IV

Innovations and Challenges in Labor Market Matching Technology

40

Part V

Institutional Roles in Labor Market Matching Technology

44

Conclusion

46

Endnotes

50

Appendix



1

Introduction

Finding the right person for a job is a crucial component of business success, employee wellbeing, worker productivity, and economic health. The consequences of getting the match wrong are high both for employees and employers—for instance, a 2008 study indicated that the cost of replacing a worker can be as much as 60 percent of an employee's annual salary.¹

Making sure potential workers and prospective employers find each other is key to making the labor market function. Given the importance of labor market matching for businesses, government, and society, it is unsurprising that in our digital world employers and prospective employees are seeking technological solutions.

The use of technology in labor market matching is not new, but recent innovations and an increase in data have resulted in modern tools that aim to address some of the thorniest issues in labor market matching, such as better sorting of skilled candidates or implicit bias in hiring. But these outcomes are yet to be fully realized.

While these new technologies offer opportunities, they also present challenges and have the potential to exacerbate old problems regarding career mobility and equitable hiring practices. The rapidly shifting ways that technology is used in the matching process without a trusted basis of validation also leads to questions about which tools are most useful, which are inefficient or potentially detrimental, and how to use these tools generally.

Imagine, for example, a job seeker looking to switch positions but who has a limited understanding of using technology. With hundreds of job boards and sites out there, how does she determine what resources best suit her particular needs?

Or consider a small business that posts an opening on a well-recognized online job board and is then inundated with resumes, without the capability to effectively sort through hundreds or even thousands of applicants. This small business also lacks the awareness of the matching algorithms available to sort through the ever-growing resume pile—or even of the existence of such advanced technology tools.

How tools are designed can have serious implications for who gets called back for the all-important in-person interview. For instance, think of a larger company looking for candidates with a discrete set of skills, but that uses technology to screen for additional or unnecessary qualifications such as a bachelor degree—effectively cutting out many job seekers who could do the job but lack the credential.



The limitations of technology are particularly concerning for low- and middle-skilled workers who have struggled to find their footing in the current post-recession economy, and more often lack the technological access, knowledge, and networks to leverage the new matching technologies.

No technology can be a silver bullet for the many challenges facing our labor markets going forward. While holding promise for job seekers and employers alike, many new technologies will need significant improvements to truly transform labor market matching.

This report aims to show how different users—job seekers, employers, and other stakeholders—are interacting with these new tools. It explores how the injection of technological platforms and applications is changing traditional labor market matching interactions. The report also identifies the benefits and challenges of using these technologies, and reveals further questions and realities that must be confronted for labor market matching technology to have its greatest impact.

Throughout the report, the difficulties facing low- and middle-skill workers are highlighted. The report is intended to serve as a platform for discussion as labor market leaders plan for future use of continually evolving technological tools for connecting workers and employers.

The report will explore the following topics by section:

- **Section II—Types of Labor Market Matching Technology:** An overview of five different types of labor market matching technology, exploring benefits, limitations, and examples.
- **Section III—Interactions with Labor Market Matching Technology:** Highlights the ways that different stakeholders interact with varying labor market matching technology.
- **Section IV—Innovations and Challenges in Labor Market Matching Technology:** Explores benefits and challenges stemming from the use of labor market matching technology, and best practices to mitigate those challenges.
- **Section V—Institutional Roles in Labor Market Matching Technology:** Examines roles for different institutional stakeholders in improving the technology used in labor market matching.

RELEVANT LABOR MARKET TRENDS

Employers and individuals are under a variety of external pressures due to broad trends, such as the advent of new information and communications technology, which places employers and job seekers on fundamentally altered terrain. Further labor market trends include:

- **Altered Relationship between Workers and Employers:** American workers are now much less likely to stay with a single employer for an extended period of time than previously.² This means that workers move more often and employers hire more frequently, creating an opportunity for technological assistance.
- **Changing Nature of Work:** The skills required for many low- and middle-skill jobs are increasingly automated, prompting an enhanced need for reskilling and retraining.³ Technology-enabled tools have the potential to help match workers with retraining programs to gain in-demand skillsets and find well-paying jobs.
- **Uneven Growth:** As the American economy continues to shift from manufacturing to services—as well as recover from the Great Recession—there has been uneven job growth by industry and geography, as well as stagnant wage growth for many Americans.⁴ Economists have noted that while worker productivity has increased significantly in recent decades, wages have not kept up with productivity gains. Technology-enabled tools allow job seekers to expand their searches beyond sector and geographic area.⁵
- **Perceived Skills Gap:** Many labor market observers point to the mismatch (either real or perceived) between the skills employers seek and those that job seekers possess. While experts disagree as to the extent of a mismatch, many employers report frustration finding qualified applicants.⁶ The difficulty is particularly acute for a number of middle-skill occupations.⁷ Technology could help employers and job seekers obtain a shared understanding of what skills are in demand, and how individuals could acquire these skills.

THE GIG ECONOMY

Gig economy platforms are another prominent example of how technological innovation has impacted the labor market. Through these platforms, independent contractors can easily offer personal services such as car-sharing or home rental directly to clients.

These platforms share some commonalities with the other tools examined in this report, both positive and negative. For example, they provide the ability to

crowdsource verification of skills, but they may also result in unchecked explicit or implicit bias, such as that documented toward guests with African-American sounding names on Airbnb.⁸

Given that this report focuses on the technologies that match workers with employers, rather than those that match independent contractors with clients, it will not address gig economy platforms more fully.

2

Types of Labor Market Matching Technology

Labor market matching technologies have responded to the needs and prevailing trends of the labor market in a number of ways, and the tools and platforms used vary in complexity and utility. The types of matching technologies considered in this report include:



Job Boards



Algorithmic Matching Technologies



Online Skills Assessments



Skill Building and Career Development Portals



Online Social Networks

While many platforms combine different technological capacities, creating unique tools that defy broad categorization, this report breaks down technologies by single functionality.

LABOR MARKET DATA

Standard across many of the matching functions is labor market data, which drives the ability to make recommendations about career paths or particular jobs. Labor market data can be drawn from a number of sources, both public and private, such as national datasets and projections produced by the Department of Labor’s Bureau of Labor Statistics.

In many cases, due to limitations with public sources of data, labor market matching technologies collect additional data “scraped” from job boards like LinkedIn, Monster, and Indeed, or gathered from institutions like Chambers of Commerce, local workforce boards, and employers themselves. This supplemental data can be helpful in tailoring tools to reflect local—instead of national—labor market needs, but can also be incorrect, out of date, or not interchangeable with national datasets.



JOB BOARDS

Online job boards are collections of job listings that occasionally include resumes from job seekers. Users of job boards can search for candidates or positions based on a number of variables or filters. While some job boards encompass multiple fields and industries, targeted job boards that focus on certain populations also exist. For example, colleges and universities, metropolitan areas, and certain industries often operate their own job boards.

Benefits of Job Boards:

Accessible and Widely Used, with Powerful Impact

Job boards are one of the most accessible forms of labor market matching technologies available. Together with social media platforms, job boards are often the only interaction that many individuals and small- or medium-sized businesses will have with matching technology. No special training is needed to understand how to use job boards properly, enabling employers to swiftly post and collect resumes, and individuals to search and apply for jobs based on key words or phrases. A recent survey by LinkedIn found that, after personal referrals, the most common way that users found their new job was through a third-party website or online job board.⁹

Although less sophisticated than other matching technologies, job boards have had a powerful impact on the ways that individuals find jobs and that employers source employees.

Job boards allow job seekers to find opportunities both in their geographic region and beyond,¹⁰ and allow employers to access a broader and more diverse talent pool. “Prior to digitization, job search by both job seekers and employers was limited,” explained Guru Sethupathy, formerly of Opportunity@Work. “Tech has played a huge role in expanding job search opportunities for firms and job seekers, especially for those with less social capital and connections.”

Finally, studies have shown that simply by using basic technology such as job boards, individuals are more

“content”¹¹ with their jobs, and experience increased tenure at their place of employment.¹²

Limitations of Job Boards:

Quantity, Not Always Quality

A serious limitation of job boards is that listings can be out-of-date, leading job seekers to waste time applying for positions that have already been filled. Searching through a high volume of listings on job boards can also be overwhelming. Even knowledgeable job seekers using appropriate search terms or other criteria to sort through listings can be daunted by the quantity of information or miss suitable job openings.

Likewise, employers who post on job boards can be overwhelmed by the number of applicants who apply for a job, leaving them with the challenging task of sorting through more resumes than are feasible to review. Additional challenges are discussed in Section IV.

EXAMPLES



Organization Category: Job Board

Target Employer: Tech companies

Target Employee: Underserved communities (gender, race, ethnicity, sexual orientation, military)

Business Model: Investor capital

Description: Blendoor is a “blind recruiting” technology that seeks to facilitate job matching based on merit. The technology hides applicants’ names and pictures to reduce unconscious biases and promote diversity hiring in tech companies. For job seekers, each listing on Blendoor includes information about a company’s employee resource groups, inclusion programs, and diversity in executive leadership. The technology’s machine-learning algorithm enables Blendoor to provide recommendations for career development. For employers who purchase subscriptions, the application provides data on the demographics and sources of applicants.

Goal/Desired Outcome: Studies have shown that the name on a resume can make a significant difference in an employer’s response. Blendoor’s goal is to make sure that employers focus on the information that is “most relevant to a candidate being a good fit” and not just their identity.

Key Feature: Blendoor combines many labor market matching technological features (job board, career development, etc.) into one platform.

Website: <http://blendoor.com/>



Organization Category: Job Board

Target Employer: Social impact organizations, including nonprofits, government agencies, social enterprises, and companies that provide services to nonprofits

Target Employee: Individuals looking for work in the social impact sector

Business Model: Employer fee

Description: Idealist is an international job board marketed toward those with a desire to work in the social impact sector. Users can search based on a number of criteria (including location, field, and keywords) and set up email alerts to be notified about positions that match their search criteria. Organizations can create a profile on the site so that job seekers can learn more about them. In addition to jobs, organizations can also post internships, volunteer opportunities, and events. According to Emily Hashimoto of Idealist, the site is identifying how to expand its services: “While our matching is currently more general—matching seekers and organizations in the social impact sector through listings—we’re actively exploring more detailed and nuanced matching technologies. We know this could be a big help to our community, so we’re examining how to make this work well.”

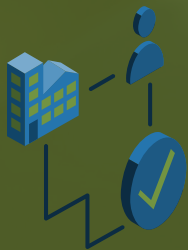
Goal/Desired Outcome: Idealist seeks to close the gap between intention and action by connecting people, organizations, ideas, and resources.

Key Feature: By focusing on social impact, the platform helps reduce transaction costs for employers and job seekers by matching them by sector.

Website: www.idealist.org/

BUSINESS MODELS

While labor market matching technologies operate using different business models, tools created by private industry often rely on employer fees rather than charging job seekers. In part, this can be due to the limited financial resources of job seekers. Tools operated by public interest organizations often do not charge either employer or individual fees.



ALGORITHMIC MATCHING TECHNOLOGIES

Algorithmic matching technologies rely on data science and machine learning to identify potential candidates and make precise matching recommendations.¹³

While the use of algorithmic matching technologies is increasing, it is still far from ubiquitous. A study conducted by the Society for Human Resource Management found that only 26 percent of employers surveyed used automated prescreening tools when assessing candidates.¹⁴

Existing technologies more often focus on identifying individuals with special skills for high-skill positions, rather than filling low- and middle-skill openings. Most employers, especially small and mid-sized companies, still rely on more traditional methods of sourcing candidates, such as employee referrals and posts on the firm's website and social media.

Benefits of Algorithmic Matching Technologies:

Superior Matching, High Potential

This innovative technology is in the early stages of adoption, and its benefits (and risks) are still emerging. The use of algorithms has been praised for the potential to diminish implicit bias by recruiters,¹⁵ and for resulting in superior matching generally as judged by workers' job performance.¹⁶ Moreover, algorithmic matching has great potential for businesses seeking candidates with a particular skillset and experience.

Limitations of Algorithmic Matching Technologies:

Perfect Becomes the Enemy of the Good

Unfortunately, algorithmic matching technologies have the potential to exacerbate some of the same issues they attempt to ameliorate. Companies may become increasingly focused on finding the ideal candidate to start with, rather than investing in on-the-job training.

Furthermore, employers conducting the search may not be aware that their subconscious idea of "perfect" constitutes someone of a particular race, gender, or socioeconomic background.¹⁷ As Jennifer Schramm of the Society for Human Resource Management remarked, "Now it's not that hard to find a needle in the haystack, but we have to be cautious that it's not building inequalities or creating a mindset that is less about developing individuals to grow and thrive in their roles."

EXAMPLES



Organization Category: Algorithmic Matching Technologies

Target Employer: General

Target Employee: General

Business Model: Employer fee

Description: SkillSmart is a platform that connects job seekers, employers, and educators through mutually identified skills. The platform allows employers to specify the skills that are needed for success in their company and helps individuals find opportunities based on their skillset. SkillSmart's algorithm calculates how closely an applicant's skills align with overall employer need. If job seekers do not have the necessary skills for a desired position, SkillSmart will provide suggestions for training opportunities. Additionally, SkillSmart helps educators to include in-demand skills in their curricula.

Goal/Desired Outcome: SkillSmart strives to “empower individuals and employers to maximize their potential” by increasing transparency in the hiring process and taking a demand-centric approach to career development.

Key Feature: SkillSmart seeks to facilitate a shift from credentials-based hiring to skills-based hiring.

Website: <http://www.skillsmart.us/>



Organization Category: Algorithmic Matching Technologies

Target Employer: Small- and medium-sized employers

Target Employee: College students, recent graduates, and young to mid-career professionals

Business Model: Employer fee

Description: WorkFountain, a division of the company Digerati, is an algorithmic decision-making tool and job board for small and medium-sized employers for high-skill individuals. Unlike a typical job board, WorkFountain uses algorithms “to connect candidates to employers based on skills, interests, and job requirements.” WorkFountain is also able to analyze candidates that are sourced through other job boards or a company website.

Goal/Desired Outcome: WorkFountain provides employers with “an efficient and effective way to recruit the talent they need to grow their business.”

Key Feature: WorkFountain makes algorithmic matching technology accessible to small and medium-sized employers.

Website: <http://workfountain.com/>



Organization Category: Algorithmic Matching Technologies

Target Employer: General

Target Employee: General

Business Model: Subscription software and data license for employers, HR management systems, higher education institutions, content providers, certification issuers, recruitment firms, and the public sector

Description: In addition to research it conducts on the labor market, Burning Glass seeks to connect job seekers and employers through artificial intelligence technology that analyzes job postings and resumes to gain insight into labor market patterns, identify skill gaps, and interpret career paths. The firm uses this data, parsed by the underlying LENS™ suite, in tools to bring employers and job seekers together. The FOCUS career application is tailored for use by labor exchanges, colleges, and training institutions. Burning Glass' findings also help educators to match their instruction to the skills demanded in the current labor market, policymakers in making strategic workforce decisions, and employers and recruiters to hire more efficiently.

Goal/Desired Outcome: Burning Glass seeks to increase efficiency within the labor market by ensuring that the supply of job seekers meets the demands of employers. The firm believes that if job seekers know which skills are demanded, they can proactively make themselves better candidates, benefitting themselves, their future employer, and the economy as a whole.

Key Feature: Burning Glass' algorithm is used by a number of labor market practitioners, including workforce agencies, HR/recruitment agencies, and academic institutions. FOCUS is embedded in career guidance systems, such as Blackboard's BbPlanner and the University of Phoenix Career GPS, and powers labor exchanges in 14 states.

Website: <http://burning-glass.com/focus/>



HUMAN RESOURCES INFORMATION SYSTEMS

Companies are starting to use human resources information systems (HRIS), a type of algorithmic matching often combined with skills assessments, to quickly filter job candidate profiles based on a number of variables. HRIS melds an established concept—managing incoming job candidates—with modern technological capacity. These systems are used primarily by employers, and job seekers rarely interact with them beyond submission of a resume through a company’s website. HRIS is also used by employers to manage professional development and skill-building for employees, especially for larger organizations.

While prospective employees may not interact directly with HRIS, savvy job seekers know about the existence of this form of labor market matching technology and tailor their resumes and job applications accordingly, for instance using common job posting keywords to “game” the technology. Because of its reliance on keyword input by job seekers, this technology is not infallible—unqualified individuals can use keywords or formatting to exaggerate their skill set and be wrongly elevated, and vice versa.¹⁸



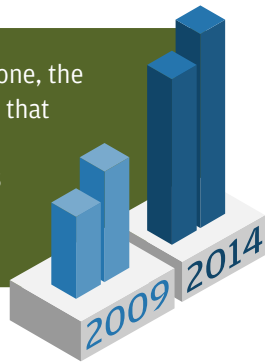
ONLINE SKILLS ASSESSMENTS

Skills assessments are used by employers and job seekers to assess an individual's suitability for a particular job or career. The focus of these tests can include job skills, cognitive ability, or behavior, and can range in form from straightforward questionnaires to more detailed games.¹⁹

Online skills assessments are often similar to more traditional tools, like the Myers-Briggs Talent Inventory personality assessment.²⁰ However, the use and function of these assessments has shifted with the advent of technology. Now, individuals can independently access a wide array of online assessments to identify their strengths and potential career paths.

Employers also increasingly use online skills assessments during the application process, with some researchers predicting that soon over 88 percent of employers with more than 100 employees will use aptitude and personality tests during the hiring process.²¹ Technology has made it easier to distribute tests and assess the results quickly and at lower cost.²² Accordingly, their use has grown and this type of assessment takes place earlier in the application process than it did previously.

Between 2009 and 2014 alone, the percentage of U.S. workers that underwent testing as part of their application process increased from 30–40 percent to 60–70 percent.²³



Benefits of Online Skills Assessments:

Better Guidance for Job Seekers

Several studies have found that drawing upon assessment tools resulted in increased “career decidedness and career maturity” and “persistence in majors well aligned with career goals.”²⁴

Low- and middle-skill workers may find online assessments particularly useful in identifying how their current skillset could lead to new training or employment opportunities in more lucrative fields. Several sites devoted to low- and middle-skill workers feature some form of online skill assessment, either one created in-house or a link to an assessment like the Department of Labor’s mySkills myFuture tool.

Limitations of Online Skills Assessments:

Questions of Legitimacy, Benefit, and Bias

Individuals are faced with a wide array of tests online, with little way of knowing which tests are legitimate. In addition, an individual’s responses on an assessment may not be a true indication of that individual’s interests or abilities. Referencing a tool developed to help students find internships, Peter Callstrom of the San Diego Workforce Partnership remarked, “As much as we believe in technology, we always need to remember that technology is just a tool—not a replacement for human interaction. We don’t rely on technology exclusively to do matching. What a young adult may choose as their interest may not fully represent what they want to do now, or in the future.”

Companies who use such assessments must also be careful to ensure that their tests are not discriminatory. For example, some questions on personality tests have been accused of violating the Americans with Disabilities Act.²⁵ These tests also rely on self-reported data, which may be inaccurate, and different types of tests may be implicitly biased against different genders.²⁶

EXAMPLES



Organization Category: Online Skills Assessment

Target Employer: General

Target Employee: General

Business Model: Candidates pay nominally for credentials; corporations pay for assessments/recruitment

Description: Aspiring Minds is a global job skills credentialing organization designed to develop a “merit-driven talent ecosystem” and enable job skills matching through assessments. The organization’s flagship product, AMCAT, is an employability test that the organization indicates helps over three million job seekers yearly. The site enables job seekers to “evaluate their job skills, earn industry-recognized credentials, and find appropriate career opportunities.” Aspiring Minds operates in the United States, China, India, the Middle East, the Philippines, and Sub-Saharan Africa.

Goal/Desired Outcome: The organization’s vision is to “create a level playing field in education and employment by introducing credible assessments” and facilitating a merit-driven labor market.

Key Feature: The employability test AMCAT uses adaptive assessment technology and machine learning algorithms to measure employability skills like language, cognitive abilities, and behaviors alongside a range of functional skills through simulated assessments.

Website: <http://www.aspiringminds.com/> and www.mymcat.com



Organization Category: Online Skills Assessment

Target Employer: Businesses in the U.S.

Target Employee: Early-career high skill individuals

Business Model: Employer fees

Description: Koru is an online predictive hiring platform for large businesses that hire a significant volume of employees. Job seekers take an online assessment that has been tailored to specific employer needs and company culture, and are evaluated on the following metrics: grit, rigor, impact, teamwork, curiosity, ownership, and polish. After completing the assessment, Koru indicates which candidates are the best fit for the employers based on these metrics.

Goal/Desired Outcome: Koru hopes to transform the way companies “screen, hire, and develop early-career millennial talent” by predicting an individual’s performance before he or she is hired.

Key Feature: Koru confronts skills mismatches by combining predictive analytics and assessments.

Website: <http://www.joinkoru.com/>



SKILL BUILDING AND CAREER DEVELOPMENT PORTALS

Individuals are able to build their skillset and learn more about potential career paths or vocational opportunities through online portals. Interest assessments to identify potential career matches are frequently a component of these platforms, and platforms often provide information regarding the credentials that are required to obtain these jobs.

These portals can be provided by public or private industry for general use or operated by educational institutions. For example, the Department of Labor's My Next Move tool provides careers and salary information, while Petrochemworks.com provides specific information on careers in the petrochemical industry in the Gulf Coast. The Department of the Navy's Credentialing Opportunities Online (COOL) tool is a sophisticated variation, offering information to servicemembers about how their experiences map onto civilian jobs and what credentials would smooth their transition.

Benefits of Skill Building and Career Development Portals:

Shared Understanding for Employers and Job Seekers

By increasing access to information through these portals, industries can signal what types of trained workers they are looking for, and people can make informed educational and career choices.

Some platforms are designed with low- and middle-skill workers in mind. For example, the SKILLFUL initiative aims to help educators, job seekers, and employers gain a shared understanding of in-demand skills for the IT and advanced manufacturing fields. Its online platform for low- and middle-skill workers links to a series of online tools to help them enter these fields, including job boards, mapping tools, and training opportunities.

Limitations of Skill Building and Career Development Portals:

Too Many Options, Not Enough Good Data

Skill building and career development portals face many of the same challenges as other technology-enabled labor matching tools. The multitude of platforms and abundance of information can make it challenging for users to determine the best tools for their purposes.

Likewise, platform operators are challenged by a dearth of up-to-date information on employers and the labor market generally, and cannot accurately communicate trends to platform users. "Where these tools are going to pull data from is critical, and being able to stay current is one of the challenging things with any type of technology," said Matt Meyer of the North Carolina Community College System.

EXAMPLES



Organization Category: Skill Building and Career Development Portals

Target Employer: General

Target Employee: Job seekers looking to enter the labor market or explore new career options

Business Model: Nonprofit social enterprise

Description: GoodProspects, a project of Goodwill Industries International, is a platform providing job training and career placement through a variety of online and in-person services. These services include skills assessments, assistance with resumes and cover letters, interview preparation, career guidance, mentorship, and events hosted by Goodwill's 164 member agencies.

Goal/Desired Outcome: Goodwill strives to enhance the dignity and quality of life of individuals and families by helping people reach their full potential through education, skills training and the power of work.

Key Feature: This platform is designed to serve workers by combining technology, digital literacy, web-based mentoring and traditional career counseling.

Website: <https://goodprospects.goodwill.org/>



Organization Category: Skill Building and Career Development Portals

Target Employer: General

Target Employee: Entry-level job seekers

Business Model: Free for job seekers, annual subscription for employers

Description: LearnUp is an online recruiting platform that specializes in the retail, food service, hospitality, call center, and customer service industries. Job seekers can use LearnUp to take online course modules to learn more about available jobs, build their skills, and receive coaching and support through the application process. Employers can use LearnUp to recruit qualified applicants. The organization indicates that individuals who use LearnUp are three times more likely to be selected for employment, and once hired, perform better and stay in their jobs longer than peers who have not used the platform.

Goal/Desired Outcome: LearnUp's mission is to build "a new model for opportunity in America" in today's challenging job market. The organization seeks to achieve this goal by identifying the skills gap that separates job seekers and employers and disseminating the information necessary to bring the two parties together.

Key Feature: LearnUp's features build on its job skills coaching and education capacity to include human resource management tools for employers.

Website: <http://www.learnup.com/>



Organization Category: Skill Building and Career Development Portals

Target Employer: General

Target Employee: Middle-skill job seekers, including those without a college degree

Business Model: Foundation support

Description: SKILLFUL is a Markle Foundation initiative to expand opportunities for employment and broaden the ways Americans learn and train for the work of the future by providing transparency around the skills a job seeker has, the skills a job seeker needs, and where he or she can find training and support to get on the path to a good job.

The SKILLFUL platform includes a curated set of career exploration and matching tools, including from its partner, LinkedIn, skill building opportunities, and career guidance for job seekers. SKILLFUL combines its online tools with Skillful coaches who work to empower a jobseeker to own his or her path to success, offering personal coaching assistance.

SKILLFUL also enables employers to adopt skills-based hiring and training practices through its tools and support, and connects educators with LinkedIn to promote their training programs and receive information on in-demand skills to inform their curricula. The current focus of SKILLFUL is on the information technology and advanced manufacturing industries in the state of Colorado and the greater Phoenix area.

Goal/Desired Outcome: SKILLFUL seeks to develop a skills-based labor market that expands opportunities for better employment for all Americans, including the 70 percent of Americans who do not have a college degree.

Key Feature: SKILLFUL, in partnership with LinkedIn, is an online and offline organization whose tools and coaches help jobseekers understand, navigate, and obtain better career pathways, and enables employers to implement skills-based practices.

Website: <https://www.skillful.com/>



PetrochemWorks.com
CAREERS FOR A LIFETIME

East Harris County Manufacturers Association (EHCMA) is the curator and owner of the www.Petrochemworks.com website

Organization Category: Skill Building and Career Development Portals

Target Employer: Petrochemical industry

Target User: High school and early career community college students

Business Model: Employer fee

Description: Petrochemworks is a career exploration and development site that helps users tap into career opportunities in the petrochemical industry. The site was created to inform students and job seekers about the petrochemical industry and help them get the education they need to prepare for a long-term career in the industry. The site features a suite of interactive tools to help users better understand the prospects the industry offers along with the skills and educational requirements they will need to take advantage of those opportunities. The experience includes matching activities to help users understand interest, skill, and educational affinity alignment, job descriptions, career maps, an industry overview, educational resources to prepare for roles, employer briefs, and job listings, many of which do not require a bachelor's degree. This tool was developed by the Council for Adult and Experiential Learning (CAEL) in partnership with JPMorgan Chase & Co. and Gulf Coast organizations.

Goal/Desired Outcome: Petrochemworks was designed for residents and companies based in the Gulf Coast region of the United States to help residents understand the industry, match themselves to jobs that are a good fit, and prepare for and secure careers in the industry, in an overall effort to help employers gain the labor source they need to be successful.

Key Feature: Petrochemworks identifies pathways to employment and offers tools for success in the industry.

Website: <https://petrochemworks.com/>



ONLINE SOCIAL NETWORKS

Online social networks allow individuals to create profiles and build online personal and professional networks. In several respects, online social networks are used differently than other labor market matching technologies. Many users of these platforms are not actively seeking new employment opportunities or potential hires. However, online social networks can be impactful when used for labor market matching.

Benefits of Online Social Networks:

Virtual Connections Increase Information

Many individuals still find work through personal connections or referrals.²⁷ Despite the increasing prevalence of labor market matching tools, “Most employers (particularly small companies) still report sourcing new hires from personal networks or employee referrals,” said Tina Ngo Bartel, Director of Business Programs and Research at the San Diego Workforce Partnership. Online social networks have the potential to supplement this method of matching.

With these online platforms, individuals can easily find who in their network has connections to a potential employer or field, and employers can search for potential future employees among existing networks. In addition, as a recent World Bank report found, crowdsourced rating systems such as LinkedIn endorsements “help control quality, build trust, and maintain a live ‘resume.’”²⁸

Limitations of Online Social Networks:

Reliance on Real-World Connections Cements Silos

While online social networks can aid individuals in developing and maintaining their real-world networks, they are limited in their impact. Online social connections are less effective than real-world connections, in part because individuals can maintain a far larger network online with much less effort.²⁹ For example, a survey of LinkedIn users found that connections on LinkedIn are most useful for securing interviews and job offers if one knows the connector offline.³⁰ This implies that the benefits of these technologies are limited for those who lack strong real-world connections.³¹

Online social network technologies can also silo users based on demographics, further limiting their utility. For example, LinkedIn, despite efforts to expand its base, is predominately used by high-earning individuals who have college degrees. A recent survey by Pew found that while 46 percent of people who graduated from college use LinkedIn, only 25 percent of those with some college and 9 percent of those with a high school degree or less use LinkedIn.³² Partially in response, social networks like WorkHands have been designed to focus primarily on those in the skilled trades.³³

This demographic stratification of online social network users has worrisome implications for social mobility. If low-, middle-, and high-skill workers lack opportunities to connect with each other professionally, an additional barrier will exist for those who wish to move beyond their current professional sphere, and for employers who wish to improve diversity.

EXAMPLES



Organization Category: Social Network

Target Employer: General

Target Employee: General

Business Model: Employer and individual fee

Description: LinkedIn is a multifaceted professional networking platform that helps users maintain professional networks and connects employers to potential employees. Individuals create profiles with professional and educational background information and “connect” with others. LinkedIn also uses sophisticated data algorithms to connect individuals to job opportunities based on their interests and skillset, and maintains an internal messaging system. While historically a platform more used by those with college degrees than those without, LinkedIn announced a “learning path” functionality to help upskill workers in March 2016.

Goal/Desired Outcome: LinkedIn seeks to assist individuals in maintaining their professional network in an efficient and convenient manner in hopes that such a network can provide job opportunities down the road.

Key Feature: LinkedIn serves as an important source for labor market information and as a platform for other labor market matching technologies.

Website: <https://www.linkedin.com/>



Organization Category: Social Network

Target Employer: General, Contractors

Target Employee: Low- and Middle-Skill workers

Business Model: Employer fee

Description: WorkHands is a networking site targeting low- and middle-skill workers, particularly those in the skilled trades. WorkHands allows individuals to create profiles that feature their certifications, licenses, skill descriptions, and images of their work for potential employers to view. Users can use Workhands to search for potential employers or employees, and WorkHands is also connected with community colleges and trade schools so that apprentices can digitally log their hours and get their careers started.

Goal/Desired Outcome: WorkHands was created to provide an online social network for those with low- to middle-skill occupations.

Key Feature: WorkHands allows users to post images of their handiwork so that they may better represent themselves to employers.

Website: <https://www.workhands.us>



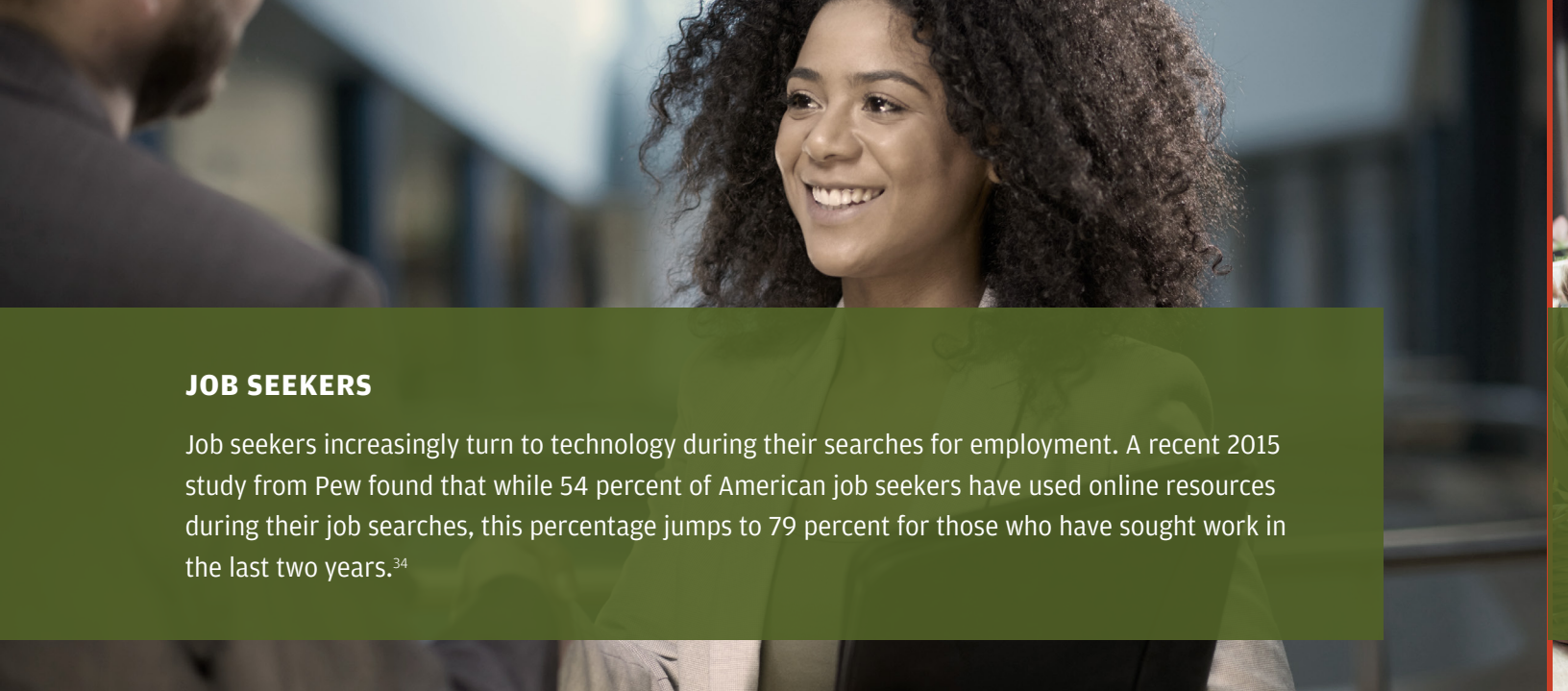
3

User Interactions with Labor Market Matching Technologies

In addition to outlining the types of technological tools and platforms are being used to connect job seekers and employers, this report seeks to understand how the injection of new technologies has altered stakeholders' approaches to labor market matching. This section explores how different stakeholders use technology tools and platforms, and the shifts that occur based on these new interactions. The following general stakeholder groups are described in this section:

- Job Seekers
- Governments
- Employers
- Training Institutions and Intermediaries





JOB SEEKERS

Job seekers increasingly turn to technology during their searches for employment. A recent 2015 study from Pew found that while 54 percent of American job seekers have used online resources during their job searches, this percentage jumps to 79 percent for those who have sought work in the last two years.³⁴

Not only do job seekers use online tools and resources, they find them helpful as well. The same Pew study found that 34 percent of respondents reported online tools were the most important resource during their job search.³⁵ The reliance and usage of online resources is likely to increase over time as tech-savvy generations mature. Already 83 percent of those in the 18-29 age bracket have looked for work online, far more than in their parents' generation. In comparison, only 43 percent of adults between the ages of 50-64 looked for job information online.³⁶

Some individuals, often low- and middle-skill individuals, may encounter barriers to fully realizing the benefits of technology in their job searches. In particular, there is correlation between educational attainment and likelihood to go online during the job search: 65 percent of college educated adults in the United States said they had looked for job information online, while only 44 percent of high school graduates said the same.³⁷

High-skill job seekers, who possess more in-demand skills, higher digital literacy, and access to the necessary technology, may find it easier to leverage a wide array of labor market matching technology tools. Challenges encountered by job seekers when using labor market matching technologies are discussed in depth in Section IV.

Julie Polizzotto

While some job seekers find online resources helpful, others are less certain. Career-changer Julie Polizzotto recently completed a tech training boot camp and is looking for a new job. "I definitely have the most success when I go to networking events," said Polizzotto. "Online job boards can be pretty discouraging, especially if you're trying to get into a new industry. Other people in my training program found jobs right away through LinkedIn, but I honestly don't see myself getting a job that way. When I do get a job, it will be through someone I know."



EMPLOYERS

Employers are highly motivated to find quality employees, but their use of technology to find these employees can vary both by employer size and the type of employee sought.

Small and Medium-sized Employers

Small and medium-sized employers tend to rely on more traditional labor market matching tools, such as job boards or personal referrals, or simply post job openings on their website. “A lot of small organizations’ hiring is relationship-driven—they rely on more localized recruitment,” said Andy Van Kleunen, CEO of the National Skills Coalition. A recent survey found that employee referrals are still the top method for recruitment for business with 1 to 499 full-time employees.³⁸ While still by and large conducted in a non-technical manner, these referrals can also be enabled through online social networks such as LinkedIn or after seeing openings on job boards.

Small and medium-sized employers’ use of more advanced technology tools for hiring is also often limited by their human resources capacity. Many small and medium-sized employers may rely on human resources generalists to manage operations, or have no designated human resources positions. Moreover, smaller employers may only hire a handful of employees a year. Between limited human resources capacity and a lesser need, these organizations can be slower to adopt innovative technologies like algorithmic matching or HRIS.

While turning to more advanced technologies may not be perceived as needed, small and medium-sized employers can miss out on the benefits that these technologies bring. For example, sophisticated skills assessments have been found to successfully predict the productivity and tenure of future employees.³⁹ This is valuable knowledge no matter the size an organization. Moreover, as discussed, some new innovative technologies remove indicators that lead to implicit bias. Drawing upon these technologies could help small and medium-sized employers support fair hiring practices.

The Chickery

Dave Bogorad is the Chief Financial Officer of The Chickery, a small fast-casual restaurant chain. His company primarily hires through job boards and referrals. “We always prefer to get a referral, especially if it’s from a good employee. In the absence of that, while I don’t love Craigslist, it’s where the [hourly restaurant] candidates are said to be and that’s what we use. If there was a better tool out there that the candidates would actually use, I’d be very open to it.” One shortcoming of another candidate management software that Chickery used was timeliness. “The software we used would vet our job postings to make sure they were legitimate, but it would cause a 24-hour delay. And by that time, we’d already gotten good candidates through Craigslist,” noted Bogorad.

Large Employers

As with small and medium-sized organizations, large employers use traditional matching methods, such as posting positions on job boards or their own company website.

However, unlike small and medium-sized employers, large employers are in a position to hire hundreds of employees each year. To meet this demand, most employers in this category have human resources departments and individuals solely devoted to hiring. The larger an organization, the more likely it is to employ automated prescreening technology to manage the influx of resumes.⁴⁰ Given the quantity of applications that large organizations receive and the number of individuals that they hire, these employers often find HRIS technology useful to track candidates referred internally. In addition, large employers looking for employees with particular skillsets have the motivation and resources to draw upon more sophisticated algorithmic technology to identify potential candidates.

Large employers are also in a better position to leverage skills assessment technologies. For employers making hiring decisions regarding hundreds of applicants, these tools have the potential to provide employers with a helpful, and relatively impartial, judgment about an employee's potential for success.

While large employers are in a position to benefit from these matching technologies, they can also suffer from a dependence on them or from inconsistent use.

For example, at a smaller organization, each individual's resume is likely read by a real person who is able to assess applicants by more than keywords. Larger organizations that rely on technology for sorting resumes must trust that the algorithms function well and that the data is valid. In addition, although larger organizations are in a position to benefit from sophisticated technology to ameliorate implicit bias in the hiring process, many still cite employee referrals as one of their top methods of recruitment.⁴¹

Kaye Foster, Senior Advisor, Boston Consulting Group

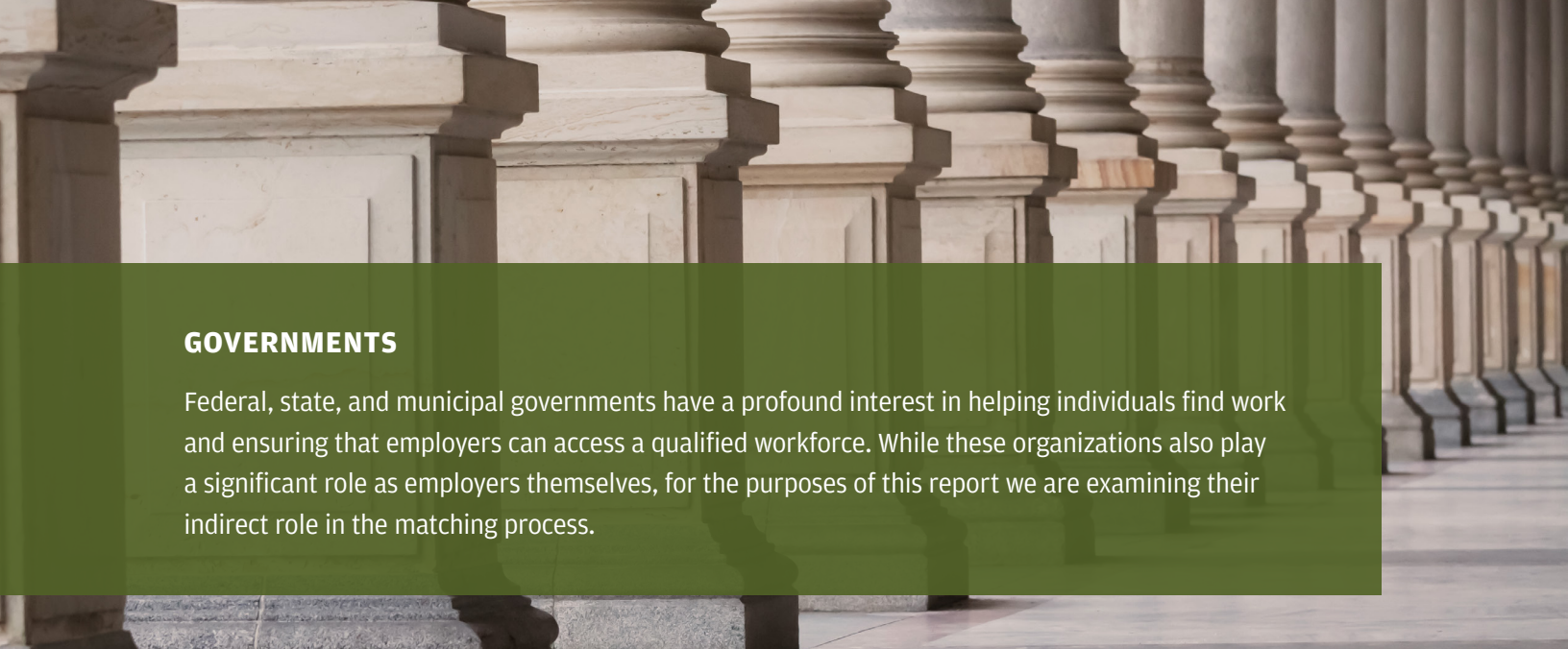
Kaye Foster, former Vice President for Human Resources at Johnson & Johnson, has worked on human resources issues throughout her career. “The field has evolved over time—in the old days, you would get paper resumes and had an army of people reading them and hopefully making good decisions,” Foster said. “Now, it's rare that you're dealing with paper.” Foster noted that technology has enabled more nuanced targeting for human resources professionals: “We're thinking about search and talent acquisition much more analytically. Building algorithms allows us to efficiently and effectively target the population that we're looking for.”



RECRUITERS AND HEADHUNTERS

Recruiters and headhunters are used by employers to help identify potential employees, particularly those with a more rarefied skillset, and technology has dramatically shifted their role. A recent survey of recruiters found that 89 percent said technology was “very important” for performing their jobs well, and only 9 percent said that they did not use special technology at all beyond email and job boards.⁴²

While technology has enabled headhunters to better identify candidates, it also makes potentially strong candidates easier to find, resulting in some individuals being flooded with solicitations.⁴³ In response to this concern, professional recruiters emphasize the importance of creating meaningful connections with candidates rather than relying solely on automated outreach.⁴⁴



GOVERNMENTS

Federal, state, and municipal governments have a profound interest in helping individuals find work and ensuring that employers can access a qualified workforce. While these organizations also play a significant role as employers themselves, for the purposes of this report we are examining their indirect role in the matching process.

Federal Government

The federal government most often uses labor market matching technology to shed light on broader economic trends. For example, the federal government uses technological tools to analyze current trends on job openings and skills needed, make funding decisions, and promote training opportunities.

The federal government has long attempted to better connect people to jobs through projections about the labor market and by issuing grants. For example, the Department of Labor's Bureau of Labor Statistics has been in existence since 1884—predating airplanes, much less computers.⁴⁵ Other branches of the federal government engage job seekers more directly, such as the Employment and Training Administration.

To help job seekers gain employment, the federal government actively works with partners to leverage technology that enables better matching, particularly through the creation of skill building and career development technologies. For example, the Department of Labor's CareerOneStop site is a multifaceted tool that helps individuals explore career options and find training, and includes specific resources for different groups of job seekers, such as laid-off workers or young adults.⁴⁶ The Department of the Navy's Credentialing Opportunities Online (COOL) tool provides service members with information about how their skills transfer to civilian careers, as well as what credentials veterans may consider acquiring to aid in this transfer.⁴⁷

US Department of Labor

The US Department of Labor oversees the National Career One Stop system, awards a wide range of discretionary grants, and facilitates partnerships among stakeholders. It also offers direct support for technology tools such as their multifaceted CareerOneStop portal, which provides information on career paths, training opportunities, and jobs. This tool can be accessed by job seekers independently as well through a visit to a career center. “Our network is robust—you can access our tools and resources on your own, or by walking into any Career One Stop Center to get linked to a variety of national and state workforce-related resources,” said Eric Seleznow, Deputy Assistant Secretary for Employment and Training at the US Department of Labor.

State and Local Government

Unlike the federal government, state and city government entities play a more hands-on role in helping connect people with jobs. Given their function of funding and distributing unemployment benefits, state governments have a strong interest in helping people find employment.⁴⁸ To achieve superior matching outcomes, many states and cities have workforce development boards that promote partnerships between public and private industry, help connect employers to job seekers through both online and offline mechanisms, and assist workers in attaining in-demand skills and jobs, sometimes by assisting individuals as they navigate new labor market matching technologies.

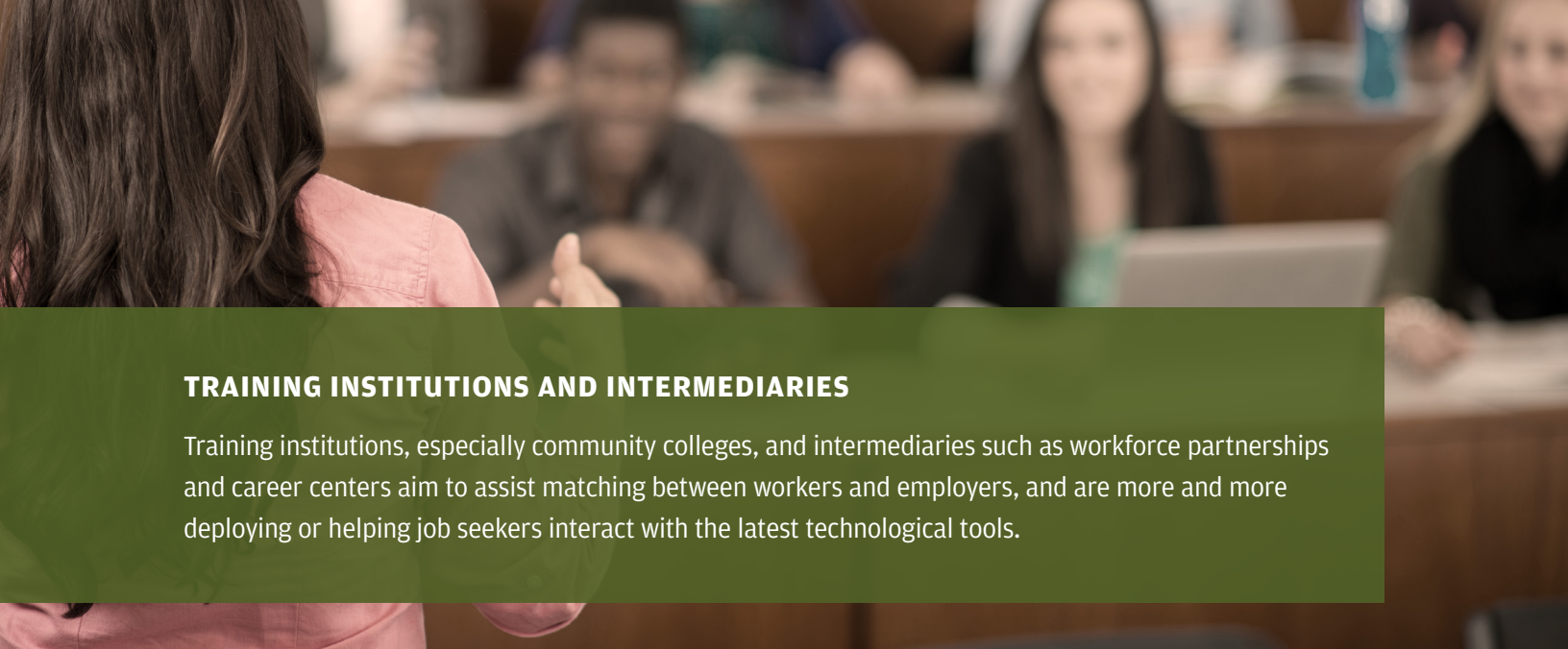
The use of technology by states and cities can vary. Some provide sophisticated portals that feature job boards, instructional videos, and career guidance materials for job seekers, as well as information on incentive programs and business resources for employers, while others provide more basic information on outdated interfaces.

There are also unique cases of cities developing special technology matching tools for specific purposes. For example, the mayor’s office in Boston created an online tool, SuccessLink, to help match local teens to summer employment opportunities in the city. After uploading their resumes, identifying interests, and completing profile information, users are able to register for opportunities with over 200 partner businesses. Users are also connected to workshops and other opportunities conducted by Boston’s Department of Youth Engagement and Employment.⁴⁹

In addition, some states have built new tools to help facilitate matching with support from federal grants. O*NET, a resource with occupational information, is the outcome of a grant from the Department of Labor to the North Carolina Department of Commerce.⁵⁰

City of New Orleans and Code for America

The city of New Orleans is partnering with the non-profit Code for America to develop tools that will help residents find employment, focusing especially on the 52 percent of black men who are unemployed in the city. One tool, PostingPro, helps employers develop job postings that highlight the skills central to a position using language that resonates with the target job seeker. Another tool, Work Forward NOLA, will help to connect job seekers and employers. “The employers who find the most value with PostingPro are those who have committed to hiring differently and are interested in tools that will help them do that,” said Efrem Bycer of Code for America.



TRAINING INSTITUTIONS AND INTERMEDIARIES

Training institutions, especially community colleges, and intermediaries such as workforce partnerships and career centers aim to assist matching between workers and employers, and are more and more deploying or helping job seekers interact with the latest technological tools.

Workforce Partnerships and Career Centers

Career centers can help individuals overcome barriers to access on many levels. They provide the basic infrastructure needed to search for a job or training program, learn how to best draft a resume, and apply for jobs online. A fundamental component of workforce partnerships and career centers is providing in-person assistance, which can involve the guided usage of technology.

While some individuals are able to use labor market matching tools independently, others may need additional assistance depending on need. Individuals that lack basic digital literacy skills need help to use computers and the internet generally. Those who have digital literacy skills but are unsure where to start with labor market matching technologies can turn to career centers for help identifying what tools to use, interpreting the results, and submitting applications.

Some workforce partnerships build their own technology tools to aid career centers' work with job seekers. These tools range in scope and intended audience, from case management for career center staff to matching tools for job seekers. However, there are also many workforce agencies and career centers that lack the resources or leadership to build their own tools, and must rely on those built by others.

San Diego Workforce Partnership

After they discovered none of the “off-the-shelf” technology met their needs, the San Diego Workforce Partnership created their own software for their youth employment readiness program, CONNECT2Careers (C2C). The platform they built in-house serves as both a case management system and an employer matching system, and is designed to be intuitive and easy to use. The tracking of cellphone text conversations was built into the system as well, after they discovered that young people respond better to texts than emails.

“We’re fortunate,” said President and CEO Peter Callstrom. “We’re able to hire software development staff to create our platform, based on input from a myriad of users. I initiated this approach as I am a big believer in technology—but only when done very thoughtfully and strategically.”

Community Colleges

Community colleges play a strong role helping their students access and use technological tools, in addition to giving them guidance on what tools and platforms may be best for their specific skill sets. While these students may have more digital literacy and access to the necessary infrastructure than other low- and middle-skill workers, community college professionals can help students learn about existing tools and help guide their usage, providing valuable in-person support.

This support can be particularly helpful as students use online tools to identify their interests and determine what academic credentials will lead to in-demand skillsets in their local area. While community colleges often rely on existing technologies built by others to help aid matching, some community college systems are working to develop their own.

Another component of community colleges’ work is partnering with local business communities to identify needed skills and to develop coursework and tools to facilitate connections between employers and job seekers. To help form these connections through technology, administrators may encourage employers to input their job opening information into the technology tools used by the colleges.

Finally, community colleges can also play a valuable role in ensuring that there is good data about student outcomes. The Workforce Data Quality Campaign, an initiative supported by community colleges and other workforce development stakeholders, promotes “key features of high-quality state longitudinal data systems and sharing best practices.”⁵¹ This information is not only useful for students as they consider which credentials to pursue, but also for employers and federal and statewide policy makers.

However, one key barrier for community colleges is a lack of resources. The ratio of guidance counselors to students at community colleges can be as high as 1 to 1,500, making the provision of quality services to students a challenge as matching technologies continue to evolve.⁵² Moreover, these counselors are also called upon to provide assistance in other areas of students’ lives, further stretching their capacity.⁵³

North Carolina Community College System

The North Carolina Community Colleges System (NCCCS) serves over 800,000 students each year. Recently, community college career coaches have increased their career counseling efforts for incoming students. As part of a new student orientation program, career counselors administered the Holland Occupational Themes (RIASEC), an online career development and personality test. Data collected by NCCCS shows that 65 percent of students reported never having completed a career assessment, and that 10–11 percent of the students assessed later changed their program based on its results. The goal is to give students a clearer direction, allowing them to transfer or enter the workforce with less financial waste and less time.

A close-up photograph of a woman with dark, curly hair, smiling and looking down at a white smartphone she is holding. She is wearing a grey t-shirt, a multi-strand pearl necklace, and large hoop earrings. The background is softly blurred, showing hints of an indoor setting with warm lighting.

4

Innovations and Challenges in Labor Market Matching Technology

Labor market matching technology is transforming how employer and job seekers interact with each other, with both positive and negative implications for the stakeholders involved. This section discusses key innovations in labor market matching technology as well as overall challenges and best practices in developing these tools.

KEY INNOVATIONS IN LABOR MARKET MATCHING TECHNOLOGY

Stakeholders including policymakers, businesspeople, and other labor market experts have turned to technology as a way to improve the matching process. Technology can increase access to opportunities that people never may have considered, create better matches between employers and individuals generally, and result in happier, more productive employees and better business outcomes.

A number of key innovations have undergirded recent changes in labor market matching technology, driven by increasing technical capacity and data processing abilities. Key innovations that illustrate the technology’s tremendous potential include:

- **Increased Efficiency:** Often technology makes a preexisting matching method more efficient. For example, online job boards are the digitization of job listings which used to be on physical job boards or placed in newspapers. In other cases, technology enables new ways of finding jobs or workers that would be unimaginable, or at least unfeasible, without our current level of technological capacity, especially with data mining and sorting. The ability for prospective employers to instantaneously sort through vast quantities of information and identify top candidates is unique to our tech-enabled era.
- **Greater Access to Information:** New matching technologies can greatly increase and improve the information available to employers and job seekers. Some technological platforms have the ability to improve the information deficit often found in the labor market by supplying stakeholders with real-time data on jobs that are highly in demand, as well as the skills that are actually present in a local labor market, all while making the processing of high volumes of data feasible. One study found that workers who used the internet as a search tool were 28 percent less likely to exit their job than those who did not.⁵⁴ This could be because job seekers who use the internet were able to make informed decisions about potential opportunities than the job seekers who did not.
- **Reduced Cost for Employers and Job Seekers:** Labor market matching technologies also have the power to facilitate successful hires by reducing friction and transaction costs in the market. Prior to the information age, the search for candidates was often limited to an immediate geographic area. This freshly expanded geography and information spread can be particularly beneficial for low- and middle-skill workers who may live in an area of higher unemployment.

Additionally, because of online platforms like job boards and social media, some of the costs associated with applying for a job have been reduced significantly. Companies receive many more resumes for each position and use sophisticated algorithms to filter those resumes, potentially increasing the chance of a successful match.⁵⁵ In many cases, job seekers face a streamlined application process and potentially more accurate, up-to-date information.
- **Skill Validation:** Finally, labor market matching technologies offer new ways to validate job seekers’ skills to employers. This validation can range from proving skills through sophisticated tests to testimonies by coworkers or employers on social networking platforms. These technologies also create a new opportunity to shift employer thinking to a more skills and competency-based hiring model due to increased information sharing, which could particularly benefit low- and middle-skill workers who can lack traditional credentials but possess in-demand skills.

THEMATIC CHALLENGES AND BEST PRACTICES

Regardless of the potential innovations above, labor market matching technology stakeholders face a number of key considerations and challenges as they interact with these new tools and platforms.

Adequately anticipating and responding to these challenges will help to maximize the benefits of technology for labor market matching in the future while mitigating and limiting negative consequences. A number of best practices in labor market matching technology have emerged, which provide an initial blueprint for stakeholders.

Challenges and corresponding best practices explored include:

- Data Availability, Validity, and Timeliness
- The High Burdens of Technological Adoption
- Implicit Bias in Hiring
- Lack of Digital Literacy and Access for Low- and Middle-Skill Workers

DATA AVAILABILITY, VALIDITY, AND TIMELINESS

As Professor Carl Van Horn, Director of the Heldrich Center for Workforce Development at Rutgers University, noted, “Imperfect information is a defining feature of the labor market.”

The sources and validity of data used for matching in the labor market have implications for the tools as a whole. Some experts and practitioners laud the ability to collect real-time information and apply it to help job seekers find opportunities. Alternatively, many are hesitant to endorse systems that often lack transparency. The public and private data that undergirds these labor market matching technologies—from job boards to online social networks—greatly affect the impact of the tool in question.

Access to quality data on labor market conditions, the nature of skills gaps regionally and nationally, and detailed analyses of occupational data by skillset are currently limited. Furthermore, many technologies rely on relatively static data libraries derived from federal government sources (like O*NET and the Bureau of Labor Statistics) or state government labor market information (LMI) data.

In a fluid labor market where the skills needed by employers and the demands of the market shift frequently, stakeholders need to understand both the landscape of the current market and how that landscape will shape the future. According to Ron Painter, President of the National Association of Workforce Boards, “The holy grail of workforce development is to have real-time data.”

Public investment in data validation, improvements in data collection, and auditing of existing public and private data has lagged behind the demand from labor market actors. As Rich Froeschle, formerly of the Texas Workforce Commission, articulated, “If the inputs for technology are bad, it’s garbage in, garbage out, just faster.” The lack of progress on data validation results from a classic collective action problem: Public institutions lack the resources to create innovative data validation tools, while private actors lack the incentive to cooperate with one another or invest heavily in improving underlying data systems.

BEST PRACTICES AND FUTURE OPPORTUNITIES

- **Third-party Standardization of Occupational and Skills Definitions:** Labor market matching technology stakeholders can ensure accurate and precise data by working collaboratively to improve data collection and standardization. One promising project is the collaboration between the Obama Administration, the University of Chicago, and other public and private organizations to create an open-source nationwide database of labor market information and skills definitions. The system will aim to merge public and private data, provide locally relevant and real-time information, and establish the basis for further innovation in labor market matching technology that will benefit all stakeholders.⁵⁶
- **Design Local Tools with Local Data:** Using local data in the design of a labor market matching tool can help ensure that the tool will provide information that is relevant to the local labor market. This can be helpful to job seekers and training institutions as they work to identify training programs that will result in in-demand skills for their region. Ongoing engagement with employers is also needed to ensure that information remains up-to-date.
- **Longitudinal Data Collection:** Documenting job seeker outcomes after using technology tools will help refine tool design and provide further information about the job market, as well as prove the value of these technologies moving forward. Determining the success of a job seeker in the job she is matched with requires partnership between job seekers and employers, with a clear emphasis on how labor market matching technologies were used.

THE HIGH BURDENS OF TECHNOLOGICAL ADOPTION

Labor market matching technology can be difficult to adopt for employers and job seekers alike, and for a variety of reasons.

Burdens for Employers

Particularly for small and medium-sized employers, adopting new technology has real costs, both in money and time. Even if new gains are made in the field of labor market matching technology, these employers and others may be reluctant to embrace them due to reliance on existing systems, the administrative burden of changing technology, and limited technical expertise. Moreover, technologies can become victims of their own success when unintended consequences lead to negative outcomes.

For example, the comparative ease with which job applications can be submitted electronically after jobs are posted on multiple job boards often means more candidates for open positions. An increased volume of applications, in turn, can also push employers to change the basic requirements for an open position to decrease the pool of applicants. Many refer to this phenomenon as degree inflation, and research from Burning Glass found that the percentage of secretary and administrative assistant openings in Atlanta requiring a bachelor's degree grew 11 percent in five years: from 28 percent in 2007 to 39 percent in 2012.⁵⁷

Burdens for Job Seekers

Given the abundance of tools that exist, it can be challenging for job seekers to determine which tools are most valuable. Moreover, some matching technological tools have unappealing interfaces that can be challenging to navigate or are not tailored for specific types of job seekers, limiting the usefulness of what could be helpful information. For example, as Felix Ortiz, founder of the matching site Viridis, remarked, “The initial inspiration for Viridis was derived from my own experiences transitioning from the military into civilian life. We were told to go on job boards, career recommendation sites, college exploration sites, in total about six or seven different sites. Literally none of them provided any value to motivated veterans who needed career guidance and access.”

Additionally, due to the ease of posting positions online, some job seekers find that openings in job boards are not always up-to-date or may contain other inaccuracies. Tools that aggregate job postings face obstacles in ensuring that cross-posted openings are not duplicated. This is a particularly acute problem for businesses like Burning Glass, which draw conclusions and make projections on the labor market using postings from sites like Monster and Indeed. This can also lead to wasted efforts on the part of job seekers or discourage them from participating in the labor market altogether.

BEST PRACTICES AND FUTURE OPPORTUNITIES

- **Enhanced Role for Intermediaries to Reduce Transaction Costs:** Intermediary organizations that make it easier for employers and job seekers to navigate the labor market can reduce the costs associated with technological adoption. For example, the National Fund for Workforce Solutions (NFWS) works to create industry partnerships in communities around the country. These partnerships gather employers from different sectors to identify needs and provide trainings for job seekers that will help them meet these needs. In effect, intermediaries like NFWS use the labor market data available to improve matching outcomes.⁵⁸
- **Platforms that Better Align and Map Skills:** Technological platforms that better align the skills demanded by employers with the skills job seekers possess would encourage the adoption of skills-based hiring. These platforms make adoption easier for employers by creating a common language for skills and point job seekers toward the correct licenses and credentials to demonstrate skills.
- **Engage Users in Design Process:** By involving both employers and job seekers in the technology tool design process, technology tool designers can make sure that their results are helpful and user-friendly for all stakeholders. This will lead to eased burdens of technological adoption and enhanced outcomes for all.
- **Continued Investment in Technology Tools and Definitions:** Once a piece of technology is created, it will require continued refinement and redesign to align with changing technology standards and best practices. Similarly, occupational and skills definitions will continue to evolve, requiring upkeep to ensure useful data undergirds labor market matching technology.
- **Partnerships between Industry and Technology Experts:** Expanding lines of communication between industry groups and labor market matching technology developers bring industry perspectives to the table during the development and prototyping process. With continuously improving tools, the number of firms that adopt new technologies would increase. Collaborative efforts by the Center for Popular Democracy to help retail employers adopt new technologies that benefit workers, such as WorkJam, are one promising example. WorkJam, a web and mobile app that enables hourly employees to swap shifts and complete trainings, combines skills-building elements with a more traditional schedule management technology.⁵⁹

SKILLS-BASED HIRING

Some considerations concern not the technologies available but the actions of labor market stakeholders themselves. Although a shift from credentials-based hiring to skills-based hiring would greatly benefit low- and middle-skill workers, many employers have been slow to adopt such practices despite technology making it possible.

Given that credentials for many in-demand skills take less time and money to attain than traditional credentials such as a college degree, a shift in hiring methods could benefit low- and middle-skill workers. Moreover, skills-based hiring could reduce the importance of more traditional credentials that may not correlate with the demands of a particular job, benefiting employers by enabling them to make more accurate assessments of an individual's skillset. Steve Yadzinski of Innovate+Educate said, “A critical thing we're trying to achieve is behavior change, in particular shifting how employers assess candidates to make the system more accessible.”

One reason for employers' reluctance is that it is difficult to precisely align the skills that are taught in training programs with the skills that are most

desired by employers, and then again to match those skills to the blueprint of a job opening. Often, communication between employers and those who design and implement training resources can be enhanced. With labor market matching technologies particularly, online content and skills training opportunities need to be more accurately matched to real-time demand from employers.

Job seekers can also feel excluded from pursuing a job opening if they lack the job requirements and have little knowledge of how to boost their skills. Integrating skill building into labor market matching technologies has increased, but many individuals are still confused as to what resources exist for them as they seek to improve their preparedness for a job.

JPMorgan Chase has joined the Lumina Foundation and many other organizations in the Connecting Credentials partnership to address problems in the current system that hamper job seekers' efforts to attain high-quality credentials. SkillsSmart, an online platform that connects job seekers and employers based on mutually identified skills, is also a pioneer in this crucial area.

HIRING BIAS

Implicit bias on the part of employers and hiring managers will continue to disproportionately and negatively impact underrepresented groups. As Jennifer Schramm of the Society of Human Resource Managers cautioned, “Bias can creep in at every step of the way if you’re not careful. Even with technology, if you aren’t thoughtful in the ways that you are using technology, bias can creep in.” Employers still rely overwhelmingly on employee referrals, with approximately 50 percent or more of jobs are gained through “informal channels” such as friends and family.⁶⁰ These referrals often reinforce the benefits of existing social networks and overreliance on generic credentials rather than merit.

While some “blind audition” practices like scrubbing resumes of identifiers may help to lessen implicit bias in hiring decisions, some warn that algorithms underlying many labor market matching technologies can be just as bad as human filters. Certain variables may serve as unintended proxies for the type of candidate that a human hiring manager would also have filtered.

Moreover, there can be a disconnect between who a recruiter or human resources professional thinks is a good candidate, and who a hiring manager eventually picks. For example, Facebook has sought to create a more diverse workforce by incentivizing recruiters to identify and elevate candidates from underrepresented groups, but recent results show that hiring managers are still hiring candidates with the same demographic backgrounds as before (as of July 2016, only 2 and 4 percent of Facebook’s workforce identified as Black or Hispanic, respectively).⁶¹

Recognition of implicit bias—and corresponding training for human resources professionals—can help to mitigate this factor. Ultimately, however, hiring is a human exercise even with the introduction of these matching technologies, and human involvement at any level of the hiring process carries with it potential for implicit bias.

BEST PRACTICES AND FUTURE OPPORTUNITIES

- **Implicit Bias Training and Awareness:** To help improve diversity in hiring by reducing the impact of implicit bias, more widespread training can be held. This training should be offered to everyone involved in the hiring process, from those conducting interviews to human resources staff to programmers developing matching software. Existing online tools, such as skill building and career advancement portals, can help individuals find training opportunities and, in some cases, enable online training.
- **Building Blind Auditioning and Diversity Metrics into Technology:** Technology developers can take an active role in reducing implicit bias in labor market matching by introducing blind auditioning practices into their technologies and emphasizing diversity metrics for job seekers. For instance, job-matching platform Blendoor removes the identifying information of job seekers from their job applications to facilitate diversity recruiting, while providing job seekers with information on potential employers’ employee resources, inclusion programs and diversity makeup.⁶²

LACK OF DIGITAL LITERACY AND ACCESS FOR LOW- AND MIDDLE-SKILL WORKERS

Low- and middle-skill workers face distinct challenges in leveraging labor market matching technologies to their greatest benefit. As the use, types, and functions of these matching technologies continue to grow, a substantial focus should be on ensuring technology is available to and assists, rather than harms, these workers.

One challenge is that labor market matching technology exists primarily online, and low- and middle-skill workers, who typically have wages below the median,⁶³ are disproportionately likely to lack access to computers and the internet at home. Only 63 percent of those with a household income between \$20,000 and \$50,000 have access to broadband internet at home, compared to 80 percent of those with a household income between \$50,000 and \$75,000.⁶⁴

Low- and middle-skill workers are also more likely to rely on just their cellphones for internet access and can face digital literacy challenges.⁶⁵ While job seekers with varying degrees of education use their smart phones for job searching at approximately the same rate, job seekers who have not attended college are much more likely to use their smart phones to fill out an online job application and create a resume or cover letter than those who have graduated from college.⁶⁶ Moreover, Low- and middle-skill workers also more frequently lack proficiency in using computers and the Internet, making it difficult to navigate labor market matching technologies.⁶⁷

Low- and middle-skill job seekers can also rely on external coaches, counselors, and mentors—such as those at American Job Centers—to navigate labor market matching technologies. Often, however, career coaches are under-resourced or can have a poor grasp of technology themselves. As Peter Callstrom of the San Diego Workforce Partnership emphasizes, “We have to have quality, knowledgeable staff to guide people in a very confusing world.”

Finally, underrepresented communities may have trouble seeing themselves in occupations not typically held by those in their social network. Technology can help to expand awareness of the universe of job openings, but individuals may still perceive a barrier to applying for a job they have not seen others in their community holding, or of which they have no prior knowledge. Guru Sethupathy, formerly of Opportunity@Work noted, “Low-income and low-skill job seekers don’t have the opportunity to try a lot of things to see what they are good at; mistakes are costlier than for those from high socioeconomic backgrounds.

BEST PRACTICES AND FUTURE OPPORTUNITIES

- **Skills Building and Career Latticing:** Labor market matching technologies can improve outcomes for low and middle-skill workers by helping job seekers learn which skills are necessary for a given job opening and, if necessary, how to acquire those skills through education and training. For example, LearnUp, profiled earlier in this report, is an integrated job-board that allows job seekers to find jobs and take online course models that help them build a skillset and interview.
- **Use Target-Audience Language:** The language used in job postings should correspond to the language skills of the target job seeker. For example, PostingPro, a tool recently launched by Code for America, assesses the grade level of language in job postings to ensure that they match the academic level necessary to be successful in the position.
- **Design for Mobile Optimization:** As discussed above, low-income individuals are more likely to rely on mobile phones for internet access. This makes mobile optimization of labor marketing tools particularly vital for this population.
- **Offer In-Person Assistance:** Human coaches can have the most impact in expanding access to labor market matching technologies and improving outcomes for low- and middle-skill workers. Better training for coaches and counselors in the technologies available and better access to resources are key components.



5

Institutional Roles in Labor Market Matching Technology

Different institutional stakeholders in the labor market can play crucial roles in mitigating challenges and ensuring that technological tools actually improve labor market matching for everyone involved. Such actions could help to improve access to labor market matching technologies and enhance the quality of the technologies used. The potential roles of the private sector, governmental bodies, and educational institutions are all described below.



PRIVATE SECTOR DRIVING INNOVATION AND PARTNERSHIPS

Private sector institutions, both for-profit and non-profit, will continue to drive innovation in the labor market matching space. Private actors can also perform a valuable role in setting the agenda for public institutions, like workforce development agencies and academic institutions, by collaborating on curricula and sharing best practices across regions and industries.

For example, Sokanu has partnered with a number of high school career centers to improve access to technology. According to founder Spencer Thompson, Sokanu Schools helps “to scale counselor services beyond the limitation of individual counselors. The biggest limitation for career counselors is quality of services and product. We offer a better experience and help counselors do their job.” Other

private sector actors have taken the lead on assisting public institutions with data validation and establishing credentialing and certification standards.

Industry organizations can also play a crucial role by marshalling the resources of multiple firms to drive the development of technology and solve common problems. Petrochemworks is an example of a technology developed to suit the labor market demands of a particular industry and region by providing better tools for employers and job seekers. Industry organizations can also be valuable partners for academic institutions and governments that wish to better incorporate employer perspectives into the development of labor market matching technologies.

GOVERNMENT PROVIDING INCENTIVES AND CONVENING STAKEHOLDERS

Government is a critical partner for labor market matching technology stakeholders. In general, government actors on the federal and state level can serve as producers and validators of labor market data and sources of public investment in ongoing data improvements.

Karan Chopra, Executive Vice President and Co-Founder of Opportunity@Work, indicated that in his view, “Government is a convener. Government can set the right incentives, has a role to play for reaching hard-to-serve populations, and can help to coordinate a series of activities.” Likewise, Professor Carl Van Horn noted, “The private sector will lead the way in

finding solutions, but the federal government can lead the way in setting standards and evaluating success.”

Some see a role for government in auditing the algorithms, datasets, and occupational definitions undergirding labor market matching technology. Such auditing would improve confidence in these systems while still maintaining the ability for proprietary, for-profit tools. Engaging with labor market matching technologies and tools like O*NET to standardize data will help workers and employers more quickly match with one another.

The Workforce Data Initiative, a collaboration between the Obama Administration, the University of Chicago, and private firms is one promising example of government engagement with labor market matching technology.⁶⁸ Another is the Texas Workforce Commission’s Common Language Project, a public-private partnership that created a skills library of common definitions for labor market stakeholders.⁶⁹

Government can also play an important role in protecting the consumers of labor market matching technologies. Additionally, it can help to create the right incentives for private actors to serve low- and middle-skill workers and develop effective new technologies. “Incentives matter,” noted Guru Sethupathy, formerly of Opportunity@Work. “Technology can help but cannot solve all the problems on its own; we have to change certain established practices that are causing the market to break down.”

ACADEMIA AND TRAINING PROGRAMS FOSTERING COLLABORATION, PROVIDING RESEARCH CAPACITY, AND OFFERING ACCESS

Four-year institutions, community colleges, training programs, and K-12 education systems are all crucial stakeholders in the labor market. In general, these learning institutions can use their research capacity to evaluate technologies, identify best practices, collect data, and improve data collection. As practitioners, academic institutions can do more to align their curricula to employers’ needs, using the data collected via skills libraries and other technologies to inform instruction and improve outcomes.

Community colleges have a significant role to play for low- and middle-skill workers in particular. For example, the Workforce Credentials Coalition in conjunction with

community college stakeholders such as the North Carolina Community College System and California Community Colleges Chancellor’s Office, has embarked on the ambitious project of creating a national portal of certification and credential data.⁷⁰ This portal will allow researchers and practitioners to evaluate the employment and wage outcomes of credentials.

Academic institutions and training programs also serve an important function in helping individuals gain access to and use labor market matching technologies. Due to their proximity to individual job seekers, these institutions are uniquely positioned to facilitate the use of this technology.

FOR-PROFIT AND NON-PROFIT TOOLS

One concern for labor market matching technology practitioners going forward is the use of public data to create proprietary tools. Some of the most successful technologies remain out of reach for small and medium-sized companies and low- and middle-skill workers due to cost or other resources. Tony Carnevale of the Georgetown Center on Education and the Workforce noted, “The private providers are for-profit and we don’t know how good their data is. In the long-term we need government to set a standard.” Some say the creation of better non-profit tools could empower smaller labor market actors and public institutions to improve labor market matching and outcomes for underserved workers.



Conclusion

As technological innovations have boosted data collection and processing capabilities in the last decade, tools and platforms using this technology have changed or accelerated how job seekers and employers find each other. Combined with overall labor market trends that see workers changing jobs more frequently and a higher need for more specialized skills, these matching technologies will have a continued and increasing role to play in the labor market far into the future.

It is clear that technology can both help and hinder groups of users, depending on how it is designed and implemented. Some tools merely shift what used to be offline into an online world, creating new and higher access limitations and hiring biases.

Technology alone is not the answer to traditional challenges in labor market matching, and existing technological tools are not without their concerns. Much of the publicly available data that contribute to labor market matching technologies is either untimely or unwieldy. Data collection responses from the private sector have shown initial promise, but challenges remain for job seekers and employers alike.

Importantly, as they currently are deployed, many matching technologies may negatively impact low- and middle-skill workers, especially if they do not enable skills-based hiring or provide in-person assistance to complement the primarily online tools.

Steve Yadzinski, Chief Operating & Technology Officer of Innovate+Educate, outlined the challenge facing labor market matching technology succinctly: “The single biggest barrier is that people constantly underestimate how challenging the market is. Understanding the matching of people to jobs is an incredibly complex problem with a tremendous variety of variables.”

An open question remains as to the full impact of labor market matching technologies on a job seeker’s navigation through his or her search or on an employer seeking to fill an open position. By ensuring that the data that undergird the technology are as precise, accurate, and timely as possible, outcomes from these technologies can start to match their promise. Moreover, by enhancing assistance and on-ramps to the technology for low- and middle-skill workers, all institutions in the labor market will help to ensure that these individuals are not left behind in using these new technologies to find employment.

APPENDIX

LABOR MARKET MATCHING TECHNOLOGY CHECKLIST

This checklist is designed for stakeholders who are seeking to create high-quality technology tools to aid the labor market-matching process. The list is divided into both design and implementation considerations, both key for successful labor market matching technology tools.

Without good design, a tool will have limited usefulness and be challenging to implement. Without good implementation, a tool will not achieve its purpose of improved matching and quickly lose relevance.

Design

- ✓ **Build with User-Centered Design:** Ensure that the tool is easy to use for both employers and job seekers by involving and consulting them throughout the tool design process.
- ✓ **Use Target-Audience Language:** The language used in job postings should avoid jargon and be familiar to the target job seeker.
- ✓ **Encourage Skills-based Hiring:** Work with employers to foster skills-based job descriptions and hiring practices rather than relying on increasingly irrelevant gatekeeping credentials.
- ✓ **Engage Employers:** Align with employers on occupational and skills definitions to develop a shared understanding among employers, training institutions, and job seekers.
- ✓ **Integrate Training Opportunities and Pathways:** Include easily accessible information on training opportunities to help job seekers gain skills to qualify for their desired positions.
- ✓ **Consider Implicit Bias Mitigation:** Reduce implicit bias in the hiring process by creating tools that do not expose employers to signals like names or addresses.
- ✓ **Keep an Eye on National Trends While Also Using Local Data:** While national trends are important, a tool that uses local data and corresponds to the realities of the local labor market will be most helpful to current job seekers.
- ✓ **Optimize for Mobile:** An online tool should be created to reflect the ways that people use the internet, and mobile optimization is particularly vital for those job seekers who lack desktop access.

Implementation

- ✓ **Support Job Seeker Needs and Access:** Regardless of how well a technology tool is designed, it should be acknowledged that some individuals will need in-person guidance to benefit from it, and that digital inclusion efforts may be needed to help ensure that everyone can access the tool.
- ✓ **Ongoing Activation of Industry Partners:** To keep a labor market matching tool relevant and useful, employers will need to post their job openings through the tool and ensure that the information reflects their changing hiring needs.
- ✓ **Recognize Need for Continued Refinement and Investment:** Since online technology quickly becomes outdated, continued investment of resources is needed to keep a technology tool up-to-date and appealing for users.
- ✓ **Analyze Outcomes:** Longitudinal data collection will help ensure that a technology tool aids employers in hiring the right person for a position by illuminating outcomes after the point of hire. In turn, this data will help determine further best practices in labor market matching technology.

LIST OF INTERVIEWEES

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