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Fixing an Imperfect

Labor Market Information System

Information technology has the potential to help people find the jobs that match their skills and develop new skills to qualify for better jobs.

Adam Smith explained that market economies operate through an "invisible hand," but what was that hand? In 1945 Friedrich Hayek argued that a market is an information system, and the challenge facing economies is to efficiently allocate resources and goods through societies with millions of participants, both people and firms, where each has only partial information According to Hayek, market pricing is "a mechanism for communicating information." Markets work, then, through the aggregation and transmission of information among the participants, and the better the underlying information, the sounder the market. Hayek maintained that markets with good information systems could be far more efficient than, for example, groups of central planners who inevitably have only partial information.

The United States has the most decentralized workforce management of any developed nation. Its labor market is highly individualized and localized, and thus fragmented with relatively few information connections among participants. On the supply side, younger workers face difficult education decisions, especially at ages 17 or 18, that will largely determine their work futures; yet they act with limited understanding about their options and the implications of their choices. Displaced workers are in a worse box; they lack the tools to understand job opening, education, and training options. And managers are increasingly frustrated in their ability to hire and retain the talent they need.

The Bureau of Labor Statistics has increased the number of occupations it tracks from 270 in 1950 to 840 in 2010. Regarding employers, there are more than 254,000 US manufacturing firms alone. The National Center for Education Statistics reports that the number of colleges and universities more than doubled between 1950 and 2014, and postsecondary programs of study have quintupled between 1985 and 2010 from 410 to 2,260. The number of college students has grown from 2.28 million in 1950 to 20.2 million in 2014. That's just higher education. The nation also has some 37,100 public and private secondary schools. Unions, which once played a significant employee aggregator and information transmission role, are in sharp decline; they represent less than 5% of the private-sector workforce. This highly complex array of vast numbers of disconnected actors exacerbates the information problem. Overall, on the skill
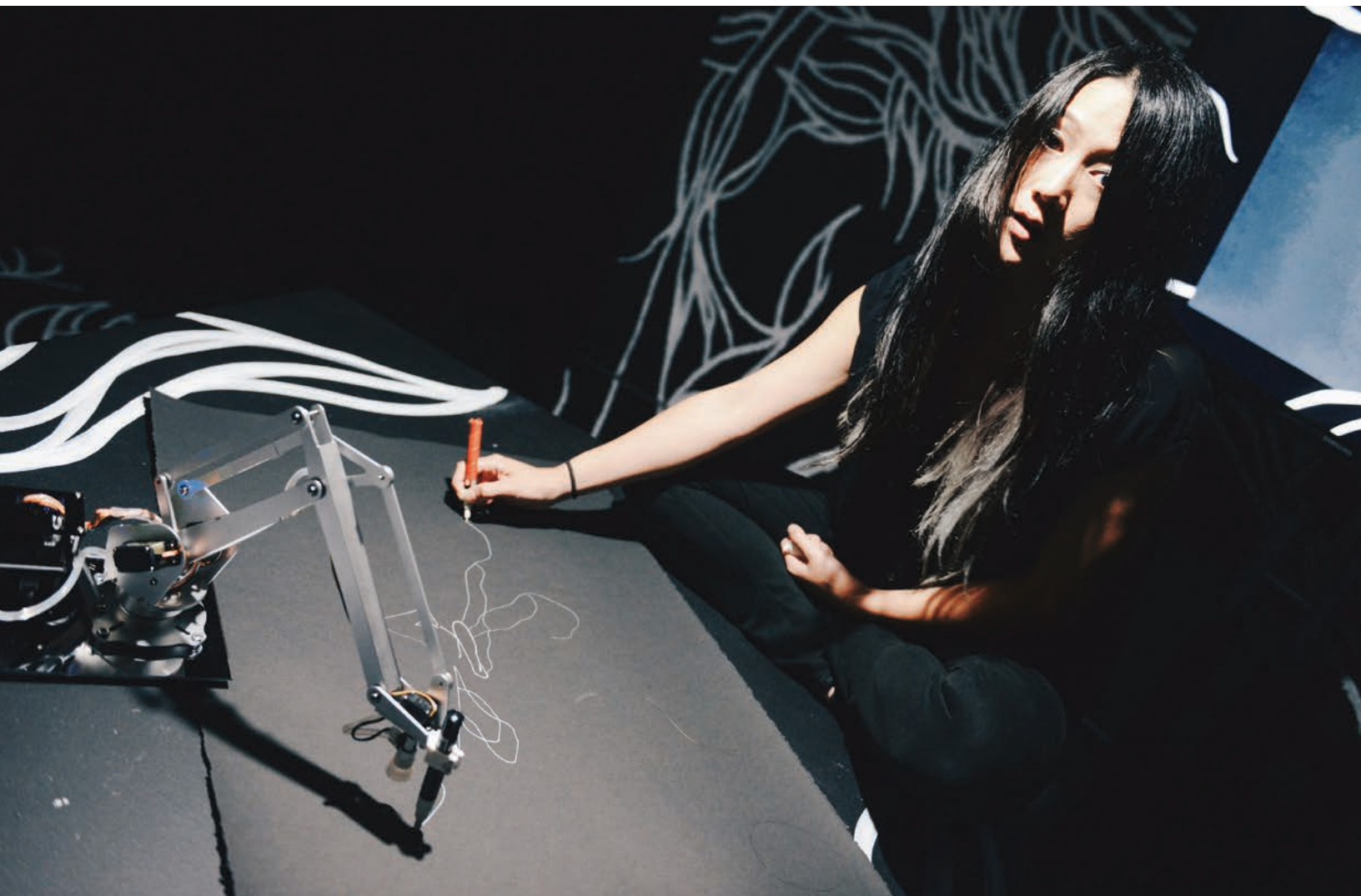
SOUGWEN CHUNG, *Drawing Operations Unit: Generation 1*, 2015; Performance, National Art Center, Tokyo

supply side, education institutions offer over 250,000 different certificates and degrees but lack the data to match them to actual job qualifications. So employers lack information about the relevance of education and of actual qualifications. On the other side of the mirror is the demand side. How much information is available on employment options, job location, skill requirements, and ways to acquire new skills? The US labor market information system is broken, and both workers and employers are largely flying blind.

Needed: a job navigator

But suppose the nation had a work navigation system that could help workers find job opportunities requiring skills adjacent to their own that they could master. The navigator could be an online guardian that collects and scans occupation shifts and alerts employees, finds relevant job openings, and identifies the skills needed on new jobs, whether soft teamwork skills, basic education skills, or technical skills. It could be finely grained and nuanced around jobs, skills, and openings. Government job displacement data and training support information could also be delivered.

The navigator could also link workers to training interventions, including training opportunities from colleges and community colleges. Schools are increasingly developing online education programs: for example, Arizona State University is offering an online bachelor's degree; Georgia Tech offers a computer science masters. EdX has 120-plus university members and 14 million learners in some 1,900 online courses; Coursera has over 150 schools as members and 33 million learners in some 2,700 courses. Digital technology firms such as Autodesk are offering online programs in design thinking, 3D modeling, and construction document management, as well as free access

to its design software. Certificate programs are extensive. The Massachusetts Institute of Technology (MIT) is now offering "MicroMasters" certificate programs in areas such as advanced manufacturing; these are open to anyone who wants to complete the courses, degreed or not. Other microcredentials programs are growing. The ideal would be to link increasingly available online education and training content to job opportunity and qualification information. In other words, an online navigator that delivers information on job shifts and job openings could also find and deliver the training that fits a worker's opportunities.

The navigator would be multipurpose. It could alert clerical retail workers to what's happening to retail jobs in their area, identifying those job sectors that are holding firm and those that are fading as online warehousing expands. It could alert these workers to complementary service fields that are expanding, such as restaurants, hotels, or office work. Health care is an expanding sector in most communities, but applicants often require new skills. The navigator could link health, manufacturing, or retail workers to job training courses, online education for new skills sets, and new job opportunities. It could also alert employers to newly trained workers who fit their needs. In other words, it could become part of the foundation for an efficient labor market.

Countries such as Germany, Austria, and Switzerland have famous apprenticeship-based workforce education systems that function well because of the personal knowledge of the system among employers and workers and extensive face-to-face interactions. The United States is unlikely to replicate the kind of workforce education systems found in these nations, but could it consider building an online information navigation system that substitutes for a person-to-person system?

The navigator's role

What would a navigator look like? Think about how Netflix sends you movie recommendations based on the kinds of movies you have been viewing, or the way Amazon makes book recommendations. In 2010, LinkedIn created a job recommendation engine that uses what are called content and collaborative filtering systems to compare job profiles with job applicant profiles. For example, it enables companies posting jobs to sort and connect to the most relevant talent potentially interested in the job; similarly, it can aid job seekers with information on relevant job openings. More advances are on the way. The University of Arizona and LinkedIn researchers are working to predict career paths, which could help guide job seekers. They are using large digital datasets on employees, skills, and companies to look at job profiles and employment, then performing data mining to map and predict subsequent career paths. LinkedIn is largely focused on professionals,

but the approach could be applicable to lower-skill jobs.

Noting the problems of increased job polarization and declines in income mobility, an MIT Media Lab team is pursuing more closely defined skill categories, relying on detailed Department of Labor occupational skill surveys. Their system can identify sets of skills, across such diverse areas as machine control and spatial orientation, that are highly complementary to identify a larger network of jobs that workers in a specific region could pursue, from pump operator to claims examiner. Their network, which is called Skillscape, shows that workers with social and cognitive skills are doing better than those with physical and sensory skills, and regions with higher portions of these skills are thriving. The network can identify bottlenecks that limit career mobility, and help locate pathways through them. In another effort, a team at MIT's Jameel World Education Lab is looking at clusters of skills and skill trajectories rather than individual skills or specific jobs, to help in longer-term skill planning and the design of skill training. This group wants a system to enable workers to see beyond just the next job, to be able to realistically assess options for achievable career pathways.

Head AI, a Finnish company, is developing a "microcompetencies" system that maps regions, cities, and organizations showing in real time which skills are most in demand and where they are needed. It is working on system to map online an individual's skills, identify employment fields that fit this personal map, and suggest additional skill areas that would help the individual meet job demands in particular new fields. It then links the individual to programs to acquire missing skills.

A review of these few examples reveals the critical elements that are evolving: a system that gives workers an appraisal of their skills and links them in real time to employers with relevant job openings and the actual skills required. The navigator must help workers not just move laterally to other jobs with their existing skill sets but also move upward to new and better opportunities; to do this it must suggest additional competencies within range of the worker's capabilities that the worker could acquire, then link the worker to education programs, online and blended, to acquire the actual skills required. As part of this, it must be predictive and assess spaces where promising employment opportunities lie. Training that is not linked to real job opportunities is pointless. And it must guide educational institutions toward offering better programs more realistically tuned to skills that will actually be needed and that can be reliably certified. These programs are likely to be short and modular, enabling workers to stack credentials that demonstrate all their capabilities. And all of this must be designed to operate at large scale.

Integrating education and the labor market

The integration of education with the labor market system
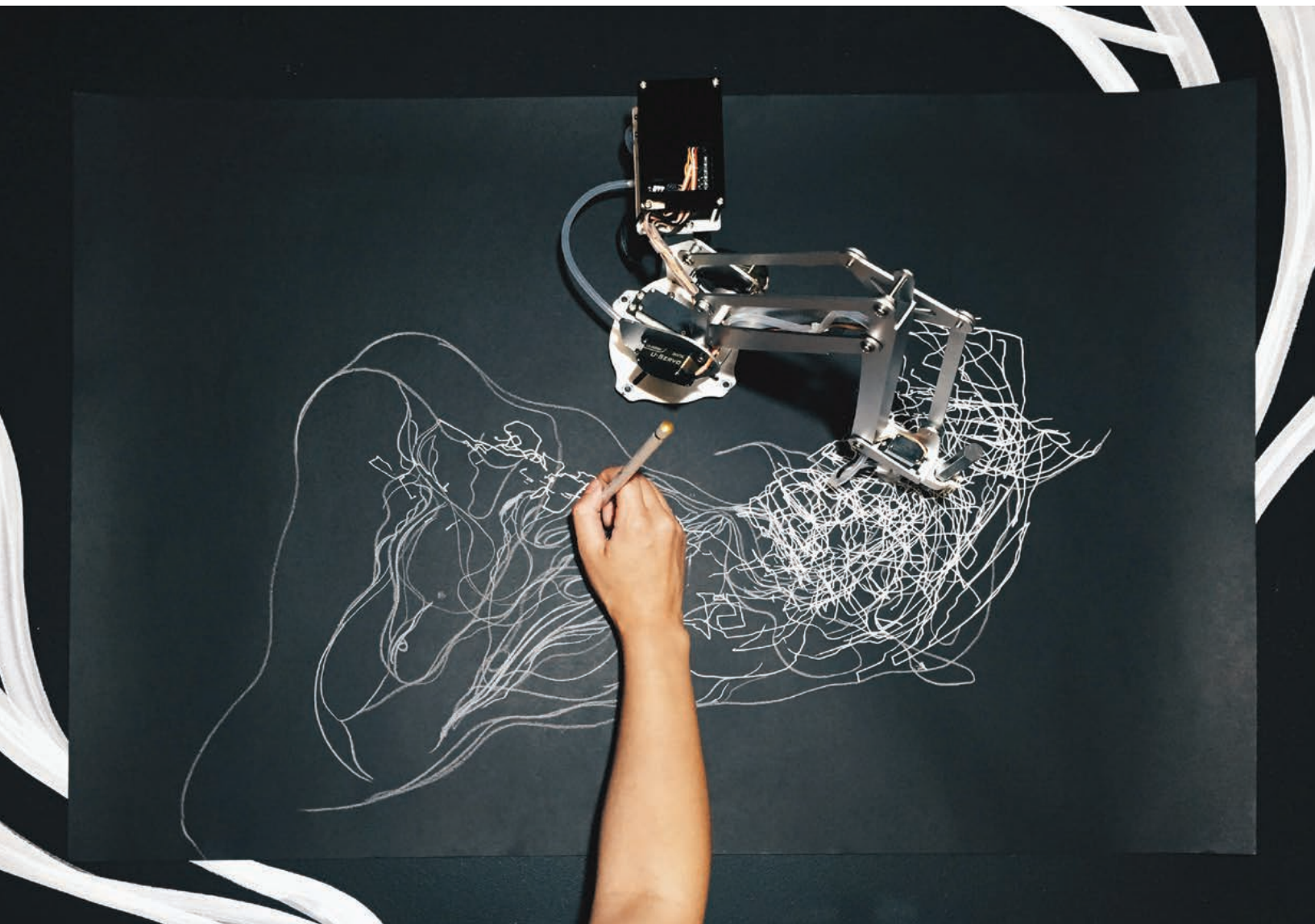
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that we need is a particular challenge. The Georgetown University Center for Education and the Workforce examined ways to leverage integrated education and workforce data. It noted in a report that a high school education no longer assures a solid workforce career. Although some college education is increasingly important to career success, simply showing college attendance and solid grades won't be enough. Increasingly, systems will be needed to unpack credentials and show their value in actual job settings. There is a maze of pathways through college education and training systems that now require measurable outcomes that can translate into workplace needs. The center's report notes that in the past states tried to meet their economic development goals and attract employers largely through tax incentives; increasingly they will need to convince employers that they have workers with sought-after skills acquired through postsecondary education and training. Talent will be the new state economic development strategy. Alliances among employers,

postsecondary institutions, and states will be essential.

Higher education administrators, in turn, will need to better align their education offerings to promising career fields, which will require them to track workforce data. Two- and four-year colleges will also have to improve their career counseling. Most students, particularly those with limited workforce experience, make decisions that will dramatically affect their career opportunities and economic well-being with little understanding of how their college choices will alter their employment prospects. Use of more predictive analytics and advice from trained career coaches could help avoid these problems. All postsecondary schools should start to support and develop online information systems in their career services to better match their students with career fields and the required education and training. The involvement of industry advisory groups could help.

The US workforce is upskilling. During the 2010-16 economic recovery, 11.5 million of 11.6 million jobs went to

workers with at least some postsecondary education. That means community colleges and colleges, like high schools before them, are now in the catbird seat for employment. In addition to building stronger links between current programs and the labor market, higher education institutions will have to expand their programs for lifelong learning to meet changing career needs. Colleges don't have to surrender the liberal arts and become career academies; indeed, the foundational analytic skills may be more important than ever. They can walk and chew gum at the same time; they can keep their foundational skills orientation but also better enable students to pursue promising careers. The Association of Public and Land-grant Universities, in keeping with its practical land-grant history, is now earnestly pursuing this twin goal.

Integration of online into navigators

Online education for particular skills can be an important tool for colleges and community colleges as they embark on this integration. And online has another advantage: it can be readily accessed and delivered from a navigation system. Different segments of the workforce require different online approaches. Displaced workers have had their lives disrupted and are often demoralized, because so much of who we are revolves around our work. With low unemployment rates, these workers are likely to have found jobs again, but frequently in lower-end services. To climb out they need face-to-face experiences in supporting communities; groups of similarly affected compatriots may prove vital to work recovery. Online training can be introduced only after this support system rebuilds confidence. Existing workers are often older and will also benefit from a "blended" learning approach, mixing live learning groups with online modules introduced over time. Newer workers entering the workforce will likely be more comfortable with larger doses of online education.

Online offerings are expanding. The National Science Foundation's Advanced Technology Education program, for example, which supports groups of cooperating community colleges often with regional universities, is already involved in developing online, classroom, and onsite training, often in blended approaches. The Manufacturing Skills Standards Council, which is supporting the skills certification system for the manufacturing sector, offers 35- to 45-hour online skills courses in manufacturing and logistics, organized in modules and available to high schools, community colleges, technical colleges, and the Labor Department's regional workforce investment boards. The National Institute of Standards and Technology's Manufacturing Extension Partnership programs are offering online skills training in many states, and the private firms 180Skills, Tooling U, and Thors offer hundreds of online on-demand courses in

a wide range of technical skills from foundational skills to robotics to welding. The 14 new Advanced Manufacturing Institutes supported by the Defense, Energy, and Commerce Departments are developing workforce education programs, often online, for the new manufacturing technologies they support. The biggest challenge is reaching the least-skilled workers. Typically, they are in less than full-year jobs, often holding two or more part-time jobs, in minimum wage service sectors without benefits. Like displaced workers, they may not understand or see the relevance of being trained on laptops or smartphones.

Florida's Valencia College offers two-year and some four-year degrees to 75,000 students on six campuses in the Orlando area. But its leadership saw that it wasn't reaching the region's sizable low-income population, often workers with families who couldn't manage the cost and time commitment of a two-year degree. This group includes workers of all ages and a significant number of Hispanics and other minorities. Valencia set out to create an intense short program that would meet their needs. It took over a new small factory that never opened because of the 2008 crash, scrounged modern equipment from area employers, and introduced an Advanced Manufacturing Training Center with six- to nine-week certificates in manufacturing skills, including mechatronics, computer-controlled equipment, and welding. The certificates met manufacturing sector and Veterans Administration standards as well as providing credits toward an associate degree. Labor Department training funds helped offset tuition. Students came into the program at minimum wage and promptly placed into $20/hour full-time, year-round jobs with benefits in Orlando's growing manufacturing sector. Valencia has created similar certificates for short-term, intensive programs in construction skills, heavy equipment operation, and medical technologies. It aims to train 25,000 students through the new centers in five years, enough to make a difference to the area's low-income population. A number of other community colleges around the country are taking similar approaches.

As Valencia saw, large portions of training must be hands-on. Community colleges must work with local employers to identify appropriate skills and gain access to the necessary industrial equipment. In addition, online training can be a practical way to develop basic skills and provide introductory instruction. The job navigator's role is to help students and workers find these programs.

Emerging tools

Bringing new technologies into online learning may help too. Digital tutors that have been developed in recent years help match online education to an individual's learning strengths and weaknesses. They use real-time assessments to identify learning problems and plug-in reinforcement and special material to fill the learning gaps. The military

has long relied on computer gaming and lately on online simulations to train its recruits. The Navy's Air Warfare Training Systems Division in Orlando, for example, has developed a suite of training simulations using virtual and augmented reality that run on off-the-shelf advanced gaming computers and 84-inch touch screens. Teams of sailors learn how to operate nuclear submarines or launch jet aircraft through simulations, touching the screen to turn valves or repair circuits. The Navy's initial finding is that those trained with online simulations gain equivalent competencies to those trained on actual equipment; both perform far better than those receiving classroom-only instruction. The Navy has moved its simulations into its 50 training schools and is now moving them onto its ships, submarines, and bases. The online simulations can run in parallel next to the actual equipment, so the simulation becomes the operating tool and repair manual for actual operations. Although private-sector employers still are asking for training on actual equipment, the services are showing that simulation technologies can be a substitute.

Few community colleges can afford a factory floor to teach manufacturing skills, so simulations, if they scale to many users, could be an affordable alternative. Versions that run on laptops could be accessed and even delivered through job navigation systems. Employers will still want some hands-on experience, but simulations could cut way back on time required on actual equipment. Virtual and augmented reality, then, coupled with computer gaming and digital tutor technologies, may offer important new ways to make training more realistic, practical, and individualized. Simulations and modeling also present new tools. The navigator could be organized to help workers find and receive the right training mix for their own learning patterns and needs.

Where are the data?

Of course, unless the information system—the job skill and job opening data, tied to rich data on training options—is available, no online navigator will work. The nation is not there yet, but there are signs this could be improving. In 2014 Congress in a rare moment of bipartisanship required the Labor Department to build a better system of workforce information, and an expert advisory panel recently submitted a host of recommendations. Aiming to better identify "in-demand occupations and industries" and to "fill a career awareness gap" for workers, the report recommended building new data bases from unemployment wage records; expanding information collection on occupations, skills, and credentials; establishing a new career-awareness education framework; and producing better information on the changing nature of work. Improved data sharing, new involvement by states and other agencies, and new analytics were also recommendations.

Labor information systems are receiving increasing attention. For example, the Chamber of Commerce Foundation is encouraging employers to develop a much deeper skills identification system for jobs they need to fill, tying it to a new, more dynamic job registry through its T3 skills credential and standards innovation network and the Clearer Signals job registry. Some 160 education and training institutions have collaborated to build a common online "Credential Engine" registry with a search system to help employers and workers understand the skills behind their certificates and degrees.

With such data systems, education providers would be able to better tailor education to actual skill needs. Online education could be a way to scale up such a navigation system, potentially creating a commons for the triangle of workers, employers, and educators. With these data, a genuinely needed job navigator to help guide US workers and employers through the maze of dysfunctional labor markets could be enabled. If we can collect the information, we can build this crucial workforce tool and rebuild the market. Alexa, maybe you could find me a job. Stay tuned.

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Recommended reading

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