WIAC Subcommittee 1 – Info-Structure

Report to the Workforce Information Advisory Council
November 1, 2017

Overview

Meeting Dates: July 18, July 25, Aug 14, Sept 11, Sept 19, Sept 22, Sept 27

Participants

- WIAC members: Mathew Barewicz (chair), Mark McKeen, Bruce Ferguson, Angela Pate, Ellen Golombek
- SME contributors:
  - Tom Giancola, DOL Innovation Council (OASAM member)
  - Individual informal interviews with:
    - Two state LMI Directors: Adrienne Johnston, Chief, Bureau of Labor Market Statistics, Florida Department of Economic Opportunity; and Jason Palmer, Director, Bureau of LMI & Strategic Initiatives, Michigan Department of Technology, Management & Budget
    - Three economists: Louis S. Jacobson, President, New Horizons Economic Research; Jennifer Hunt, Professor of Economics, Rutgers University; and Jesse Rothstein, Associate Professor of Public Policy and Economics, University of California, Berkeley

Materials

- See the Appendix at the end of this document

Workforce and Labor Market Information (WLMI) Improvements

Improvement 1 – Create a 21st Century WLMI System Using Advanced Technologies

Introduction: As a foundation to address potential improvements to the WLMI System, we started by looking at the US Department of Labor (DOL), Information Resources Management Strategic Plan for Fiscal Years 2014 – 2018. This was an insightful overview of the key objectives and strategic goals DOL had in focus when the report was developed. Five strategic goals were articulated in that document:

(1) Modernize the IT Infrastructure
(2) Share Information
(3) Deliver Smarter IT
(4) Enable the Workforce
(5) Enhance IT Management

While the overall DOL 2014 – 2018 plan was appropriate for the time frame, the WIAC recommends the Secretary of Labor provide the following direction to the Bureau of Labor Statistics (BLS) to improve WLMI systems and the Employment and Training Administration (ETA) in utilizing those systems. Additionally, we hope these ideas are shared with the DOL Chief Information Officer (CIO) to encourage open architecture and open data approaches, as described below, when developing the DOL 2018 – 2022 Strategic IT Plan. Distributed Knowledge Management Systems (DKMS) and

other open access and distributed solutions are being adopted by other government agencies and the private sector in developing emerging Web 3.0 protocols and technologies. DOL should embrace the collaborative and rapidly changing technology landscape evolving in the public and private sector to maximize innovation.

Overarching Recommendations for Strategy Development

- Leverage the knowledge and insights of subject matter experts (SMEs) in the use of advanced technologies, including DOL employees and external SMEs identified in this document, in the development of a 2018–2022 Strategic IT Plan for an improved WLMI system. This should include a comprehensive Request for Information to gather emerging technologies and design thinking from all available resources, public and private.

- Create a development roadmap summarizing the current DOL IT landscape and a vision of how an open access, distributed technology ecosystem can accelerate WLMI innovation. Identify specific investments necessary to develop open source architecture and collaborative software tools and training. A focus should be on customer centric design such as user customized interactive communication with a smart knowledge system (think machine learning) rather than only providing tables of raw data.

- Determine funding levels needed to achieve the vision as well as benefits, such as improved interaction with end users of data and 3rd party developers.

Why an Open Access, Distributed Technology Development Ecosystem is Critical: Open access allows knowledge, skills, data, technologies, inventions, and products to be developed at an increasingly faster pace. New concepts, methods, models, frameworks, and software architectures enable totally new ways of doing things. Open access reduces advantages of scale and reduces the need to build technology in house. Examples:

- Open-source software (Android, Linux)
- Open-source development/collaboration (GetHub)
- Open-crowd product development/collaboration (Quirky)
- Open innovation (Innocentive)
- Open Application Program Interfaces-APIs (Google Maps, Open AI)

Source: Rethink X Sector Disruption Report, May 2017, James Arbib and Tony Seba[1]

Developing an open source ecosystem will allow DOL to keep pace with technology advancements and better meet stakeholder needs. Additional rationale and more specific recommendations follow.

What: *Create a 21st Century WLMI System* that is based on a Distributed Knowledge Management System (DKMS), provides for an open architecture and open data approach, and uses Artificial Intelligence (AI) and related advanced technologies and tools to:

[1] https://www.rethinkx.com/press-release/2017/5/3/new-report-due-to-major-transportation-disruption-95-of-us-car-miles-will-be-traveled-in-self-driving-electric-shared-vehicles-by-2030

- Make WLMI more accessible, dynamic, up-to-date, and relevant for all users—jobseekers, employers, students, educators, workforce system practitioners, researchers, and policymakers.
- Transform the WLMI system so that it provides knowledge as opposed to only large volumes of information to decipher, and moves from a system of separate, centralized datasets or databases to one based on the concept of distributed data.
- Create a WLMI system with more intelligent knowledge systems aligned with new protocols and technologies for the emerging versions of the World Wide Web. Users need knowledge, not data. Most users are not adept at gathering and interpreting large amounts of disparate data.
- Reduce the costs of software development, data production and maintenance over time.

This is a comprehensive endeavor consisting of three inter-related elements.

(1) Strategic planning and design of the DKMS and identification of the AI technologies that are specifically focused on various targeted users to provide a customized knowledge experience
(2) Preparing the underlying, core datasets that will be part of the DKMS (e.g., selected ETA and BLS datasets) by employing a common or standardized data structure (e.g., data schemas such as those found on schema.org, formats, elements/definitions) important to the efficient deployment of an AI-driven DKMS
(3) Phased-in implementation planning, development, and deployment of the DKMS and AI technologies

It is important to note up front that currently most AI applications involve "narrow AI" which addresses specific applications such a self-driving vehicles, language translation, image recognition, trip planning, and medical diagnosis to name a few that most of us are familiar with. This is also what would be employed in a new AI-driven DKMS for WLMI. The long-range future (decades away) involves "general AI" whereby an AI system exhibits intelligent human behavior across the full range of cognitive tasks.

Why: According to the Executive Office of the President, National Science and Technology Council (NSTC) October 2016 report on *Preparing for the Future of Artificial Intelligence* and its companion report, *The National Artificial Intelligence Research and Development Strategic Plan*, the current wave of AI progress began around 2010 and has markedly expanded since then based on three inter-related factors: "availability of *big data* from a wide range of sources both government and private; which provided the raw material for dramatically *improved machine learning approaches and algorithms*; which in turn relied on the capabilities of *more powerful computers*." Simultaneously, industry has increased its investment in AI technologies with Google, IBM, and others leading the way (think IBM Watson for example). According to the NSTC, new technologies such as AI and a key subset, machine learning, hold great promise for increasing government effectiveness in many ways including its ability to serve the public faster, more effectively, and at lower cost.

The work of the DOL Innovation Council, consisting of DOL employees drawn from across the Department, involved exploring the use of advanced technologies, and in particular focused on several workforce and WLMI areas described later in this document. This WIAC proposed improvement aligns with the work of the Innovation Council whose efforts represent important first steps to infuse the use of advanced technologies in the modernizing of government IT/data systems. The *Overview of DOL-Wide Innovation Projects* provides a summary of their efforts.

Most importantly, we note that this improvement supports the Trump Administration's focus on the need for technological advancement in the provision of government services and as a means to spur economic growth. The *President's Executive Order (EO) on the Establishment of the American Technology Council, May 1, 2017* states: "It is the policy of the United States to promote the secure, efficient, and economical use of information technology to achieve its missions. Americans deserve better digital services from their Government. To effectuate this policy, the Federal Government must transform and modernize its information technology and how it uses and delivers digital services." This Council, consisting of Federal cabinet department and agency heads, was formed to implement that policy. This WIAC proposed improvement can support DOL's role on the President's Council.

Given the above developments, the time is right for DOL to examine the feasibility of applying these advanced technologies to WLMI. Like investments in roads and bridges, investments in the WLMI system infrastructure are needed. This would enable enhancements in the development of and access to data that is usable as knowledge and provides answers to questions. This would empower those currently not benefitting from WLMI in reaching greater prosperity individually and in their communities.

The following five items address a combination of specific reasons for moving in this direction, key concerns or obstacles to be addressed, and examples demonstrating the use of AI technologies.

(1) The current WLMI technological infrastructure (hardware, software, and Application Program Interfaces or APIs) is old and cannot efficiently handle today's user demands for easy-to-find, up-to-date, actionable data and insights. The current WLMI system provides a wealth of "big data" produced by ETA and BLS, but accessing the data is often confusing and overwhelming to users, especially those who do not have strong statistical knowledge or awareness of accessible information. Furthermore, it is often difficult and/or costly: to maintain "big data" sources and keep them up to date given the changing nature of the US economy and the lag time between data production and release; and to integrate these "big data" sources, including integration with other sources such as those maintained by the Census Bureau and Department of Education. This makes it difficult for jobseekers, employers, students, educators, workforce system practitioners, researchers, and policymakers to gain immediately actionable insights from current sources. While significant progress has been made to date to better serve user needs, we are a long way from the future of what could be. For example, in a DKMS, knowledge discovery and data mining applications could facilitate solutions that provide (at the very least) the same level of user experience for job or employee searches as online retail shoppers have in finding just the right shoe or car. "Inventory" for the labor supply chain could also be analyzed as is done in commercial applications using next generation web technologies.

(2) Current WLMI datasets are for the most part built using closed database architectures and data ownership structures which inhibit external application development, independent research, and public usage of WLMI. Data warehouses/closed databases (such as O*NET, currently updated every ten years) would be leveraged and included as part of the new Distributed Knowledge Management System. Once DKMS standards and rules are established, including those governing privacy, confidentiality, and data ownership, users would be able to add "knowledge" to the system such as new definitions or new occupations, which would be curated by experts. For example, the occupation of a drone operator, which does not yet exist in O*NET but is an emerging and increasingly high demand occupation as drones evolve beyond military applications, could be added by employer users through populating their job postings in the same data formats used by O*NET. Such postings could be mined and reviewed by experts for acceptance into O*NET as a new

occupation. In addition to direct users adding to the "knowledge base," open architecture/open data approaches would allow for commercial entities to more easily develop applications using the underlying rich sources of data in ways that address specific user community needs, thereby accelerating access and usage in ways the government alone cannot do given budget constraints. Through a DKMS, use of specific AI techniques, and development of standards and rules, the underlying data produced by ETA, BLS, and others retain their validity, reliability, and accuracy, but usability can be expanded exponentially.

(3) Standardization of data structures—data schemas, formats, elements, and definitions—is a key underpinning of an AI-driven DKMS—and would need to be a key component of any DKMS development effort. Currently, there is a standard dataset including common formats, elements, and definitions covering many of the *primary WLMI resources (*see *Workforce Information Database)*. However, this standardization does not necessarily govern all datasets one might want to include in a DKMS. While, in general, standardization would expedite the data collection process and assist in expanding access to WLMI in frameworks that are more useful to the public, such standardization is necessary for an AI-driven DKMS. Lack of standardization limits the ability for traditional closed database architectures to evolve into tomorrow's DKMS. Examples of systems working toward standardization for distributed or public usage include: electronic health record standardization for public/private institutional usage under highly constrictive HIPPA compliance regulations (Health Insurance Portability and Accountability Act); and global financial institutions' Legal Entity Identifiers (LEI) as regulated by the *LEI Regulatory Oversight Committee*. WLMI needs to evolve along with healthcare and financial information to be used by many public and private stakeholders through innovation and use of new technologies.

Standardization would also involve defining the standards and rules for data owner and user engagement with the system, especially with regard to the development of external applications by commercial or other entities and the "adding of knowledge" to the knowledge base by any user. Methodologies such as human centered distributed information design could be employed to help develop a future WLMI web-based knowledge management system.[2] See also the work of *schema.org,* a collaborative community established to create, maintain, and promote open source schemas for structured data, founded by Google, Microsoft, Yahoo, and Yandex.

Finally, standardization is needed to facilitate machine learning which is one of the most important AI technical approaches, and is often referred to as a major subset of AI. Modern machine learning is a statistical process that starts with a body of data and tries to derive a rule or procedure that explains the data or can predict future data. This approach—learning from the data—contrasts with the expert system approach wherein programmers take the rules and criteria established by others and translate those into software code. An expert system aims to emulate the principles used by human experts, whereas machine learning relies on statistical methods to find a decision procedure that works well in practice. Machine learning can therefore, over time, reduce the costs of software development. Standardizing data schemas, formats, and elements/definitions can reduce the cost and difficulty of making new datasets useful within an AI-driven DKMS. In addition, once standards and rules are defined, use of open source statistical software such as RStan and Semantic Web frameworks such as the Probabilistic Resource Description Framework (pRDF) can be deployed in useful ways. And, intelligent search engines can find more contextual data to provide a simpler and more usable user experience – increasing public usage among the full range of WLMI customers.

[2] See example: Human-centered design of a distributed knowledge management system such as Mission Control Center at NASA Johnson Space Center: *http://www.sciencedirect.com/science/article/pii/S153204640400156X*

(4) The use of AI engenders fear of unintended consequences concerning justice, fairness, safety, and accountability, as noted by NTSC and others; yet there are techniques that can be employed to address such issues. Examples of issues include: criminal justice use of risk prediction tools by some judges in criminal sentencing and some prison officials in assignment and parole decisions may generate rationally biased risk scores; machine learning models applied to screening job applicants could lead to biased hiring decisions; and maintaining the confidentiality of Personal Identifiable Information (PII), a core responsibility of government data collection and dissemination. In general, weeding out potential inherent biases is based on ensuring the underlying datasets used to build the machine learning model are devoid of such biases and the model is applied in an unbiased way.

With regard to issues such as maintaining confidential personal data, both the finance and health care industries have distributed data sets across both public and private host sources with protocols in place that manage critical private data. Labor market information is no more critical than personal health or finance data. There are also new techniques such as blockchaining that have emerged. Per the August 2017 PC Magazine article *Blockchain: The Invisible Technology That's Changing the World,* blockchaining can be used to protect "the facts and information we don't want accessed, copied, or tampered with. Blockchain gives us a constant—a bedrock we know won't change once we put something on it and where a transaction will be verified only if it follows the rules." While first developed by Bitcoin, its use has exploded recently. According to the article "big business is using blockchain-based smart contracts to execute all manner of complex business deals, legal agreements, and automated exchanges of data. Companies such as Microsoft and IBM are using their cloud infrastructure to build *custom blockchains* for customers and experiment with their own use cases. On the academic side, researchers are exploring blockchain applications for projects ranging from digital identity to medical and insurance records." In essence, blockchaining provides the technological capability to track, assign ownership to, and otherwise maintain the confidentiality of any information asset.

Additionally, we note the Executive Office of the President, Council of Advisors on Science and Technology May 2014 report on *Big Data and Privacy: A Technological Perspective,* which discusses the changing landscape of privacy as computing technology has advanced and "big data" has come to the fore. Among the several recommendations put forth, the report focuses on the need for policies and technologies to deal with the *actual uses of big data* versus the regulation of its collection, storage, retention, limitations on applications, and analysis.

(5) AI technologies are already in use as noted by various general examples used above; to further illustrate their efficacy, some specific examples of successful uses of AI/machine learning and emerging examples of its application to WLMI follow, drawn from NTSC reports and other sources.

- Defense Advanced Research Projects Agency (DARPA), "Education Dominance" program sponsors the development of digital tutors that use AI to model the interaction between an expert and novice in order to reduce the amount of time needed for new Navy recruits to become technical experts. These and other digital tutor pilot projects show preliminary evidence of success, although development costs are high.
- The Department of Veterans Affairs is using AI to better predict medical complications and improve treatment of severe combat wounds leading to better patient outcomes, faster healing, and lower costs.

- Autonomous sailboats and watercraft are used to patrol oceans carrying sophisticated sensor instruments collecting data on changes in Arctic ice and sensitive ocean ecosystems in operations that would be too expensive or dangerous for crewed vehicles.
- *Google for Jobs* is using AI to provide jobseekers and employers with an improved job matching experience, including a suite of tools for employers to guide the standardization of their job postings, data testing, and tracking analytics.
- *Google Cloud Jobs API* is using two main proprietary ontologies that encode knowledge about occupations and skills as well as relational models between them. The occupation ontology is an enhanced evolution of the O*NET Standard Occupation Classification.
- The University of Chicago, Center for Data Science and Public Policy (DSaPP) and its partners are working with ETA and the Workforce Data Quality Campaign (WDQC) on an open source initiative concerning Eligible Training Providers (ETP) whereby they are creating a toolkit of open source software modules and electronic tools to improve and make it easier for ETP accountability reporting under WIOA. And, DSaPP's *Open Skills Project* is working to gather and integrate data on training, skills, jobs, and wages and combine them with cutting edge big data techniques to make the results open and available, enabling a new ecosystem of products and services. The project publishes standardized job titles, skills, and training outcomes to provide the foundation of a more *open, connected and interoperable* workforce data ecosystem, and is focused on providing a dynamic, up-to-date, locally-relevant, and normalized taxonomy of skills and jobs that builds on and expands O*NET data resources. It also provides an *Open Skills API* which is an interface for developers to build applications using data produced by the *Open Skills Project.*
- DOL Innovation Council participation in a "hack-a-thon" yielded some interesting applications concerning WLMI as follows (Note: Subcommittee needs to verify all of this bullet and the one above re: DSaPP with Tom Giancola, and the Innovation Council overview document noted up front.)
    - *Training Finder:* Uses data from eligible training provider lists (ETPL) to surface education options that lead to in-demand careers for job seekers.
    - *Job Seeker:* Uses skills data from O*NET and the Workforce Data Initiative to match individuals to the jobs in their area that provide the greatest opportunity for personal and professional success.
    - *Opportunity by Hackernest:* Uses labor/employment information from multiple federal data sources to help navigate careers in government.
    - *CareerSpark:* A mobile application that uses employment statistics and occupational data from the Bureau of Labor Statistics to make career exploration easy and accessible for high school students.
    - *O*NET/Alexa*: Uses Alexa (Amazon's personal assistant) to ask questions/obtain information from O*NET.

How: Given the long-range nature of this endeavor, only ***Initial Strategies*** to move the project forward are included. It is important to note that WLMI improvements concerning data gaps and related proposals by Subcommittee #2 are critical areas to be pursued so that the underlying datasets that would eventually become part of an AI-driven DKMS are as strong and robust as possible. Additionally, the strategic planning and related processes noted below would take into account the timing of those specific data improvements, and would include suggestions for employing a common or standardized data structure that could be implemented at the same time as the underlying data improvement to better prepare datasets for inclusion in the DKMS.

(1) Establish a ***Strategic Planning and Design Task Force*** under the auspices of the WIAC and in collaboration with ETA, BLS, and any DOL technology initiative that may be established by DOL to support the President's American Technology Council to:

- Conduct research as necessary into the current and future state
- Work with DOL procurement office on issuing a Request for Information (RFI) to obtain public and private sector and other expert knowledge and insights into the application of AI and machine learning to WLMI
- Work with the DOL Chief Information Officer (CIO) to include this effort in the next DOL Information Resources Management (IRM) Strategic Plan
- Develop a Strategic Plan and Design, including a concrete Vision Statement and Identification of Core Datasets to include in the AI-driven DKMS, based on findings and WIAC direction (high level, 21st century technology roadmap for the WLMI system)
- Present the Strategic Plan and Design to the WIAC for adoption, and subsequent submission to DOL for approval, including next steps concerning a feasibility/pilot study
- Based on DOL approval of the plan/design, work with DOL procurement and program offices to determine feasibility/pilot study Request for Proposal (RFP) specifications and resource allocations; once overall specifications for the pilot are determined, the Task Force will have completed its work, and the assigned DOL program office would take the pilot project to the next level (see #2)
- Work with DOL BLS and ETA IT/technical staff to identify ballpark costs
- Identify and develop partnership agreements with private and non-profit sector partners to work with the Task Force as technical experts (see #4 below)
- Prepare a white paper on findings from all of the above for presentation from the WIAC

The Task Force would consist of an appropriate mix of IT experts, technical experts, and program experts drawn from DOL/ETA/BLS, would include one or two WIAC members and representatives from user communities, and may include technical experts drawn from partnerships with academic institutions (see #4). The Task Force would not exceed eight (8) members.

(2) Conduct a ***Feasibility/Pilot Study,*** through issuing the RFP to obtain a contractor with the requisite technical qualifications. The assigned DOL program office would complete the final steps in conjunction with the procurement office to issue the RFP and secure the contractor, oversee the conduct of this study, and provide periodic progress reports to the WIAC.

(3) Obtain ***Initial DOL Budget/Resource Support*** to carry out the initial Task Force activities described above. Federal resources, both in kind through federal employee staffing of the Task Force and hard dollars to provide general contractor support to the Task Force would constitute the initial, seed investments needed to move forward. Assuming the RFP for a Feasibility/Pilot Study is adopted, specific budget costs would be developed at that time by the Task Force. This pilot would be submitted for funding under the WIOA pilot, demonstration, and evaluation provision and associated ETA budget line item.

(4) Explore development of a ***Public/Private Partnership*** with key education institutions active in AI research and application. Recognizing that budget constraints may limit the scope of this improvement, we suggest exploring development of a partnership with key education institution(s), and possibly establishing an internship or cooperative education program (or more formal partnership). This partnership should include US private sector organizations willing to collaborate on such institutional research within a public/private partnership. The partners would

assist the Task Force in developing a 21st century technology roadmap for the WLMI system (strategic plan/design), serving as technical experts. Some possibilities identified to date include:

- The Applied Statistics Center@ Columbia University – Andrew Gelman, Professor, Department of Statistics gelman@stat.columbia.edu
- MIT Computer Science and Artificial Intelligence Lab – Regina Barzilay, Delta Electronics Professor regina@csail.mit.edu
- Rensselaer Polytechnic Institute – *Tetherless World Constellation - Linking Open Government Data* –James Hendler and Deborah L. McGuinness
- Rensselaer Polytechnic Institute – *Health Empowerment by Analytics, Learning, and Semantics (HEALS)* – James Hendler, director of the Rensselaer Institute for Data Exploration and Applications (IDEA)
- University of Chicago, Center for Data Science and Public Policy and its partnership network – *dataatwork.org*

(5) Develop a ***Phased-in Development, Implementation, and Deployment Plan*** for the AI-driven DKMS. This would be the final stage of planning and related activities. It is too far into the future to determine specifics at this time.

Improvement 2 – Increase Public Awareness of Industry, Occupation, and Skill Data

What: *Increase Public Awareness* by having DOL create an educational framework for industry, career, and skills awareness for use by educational institutions on a voluntary basis. The creation of replicable, usable materials for use in public education settings (K-12 schools) will be designed to promote proficiency in basic labor market concepts. The educational framework will leverage current resources such as ETA's myskillsmyfuture.org, mynextmove.org, industry competency models, and the "library" of career guidance and planning materials contained on ETA's career one-stop web site.

Why: As reported by BLS, the labor force participation rate of young people has been declining. In addition, the BLS projects the decline to continue. Postponement of entry into the labor market has negative effects on individuals and the economy as it delays important experiential learning in the labor market. Early job searches and early employment inform future decisions on education and career pathways. For example, too often young people learn about career technical education after high school or realize after post-secondary graduation that they are not interested in employment in their field of study. Systematic dissemination of critical industry, occupation and skill information will reduce the number of "wrong turns" people starting out in the labor market make.

Current reference materials are excellent but lack ample context. Too many people are unaware of the economic infrastructure of modern society sufficient enough to understand how their unique skillsets could help them to profit from gainful employment. The public's lack of awareness is not limited to industry but also occupations and skills. This educational framework recommendation seeks to enhance students understanding of their unique skillsets and their transferability into employment or further educational opportunities.

How: The educational framework would package existing DOL resources for use by the public education system through a partnership. Developed with the assistance of educational professionals, the information will be general enough to use as is or could be customized based on local labor market information. By highlighting the language of industry and occupation with an emphasis on transferable skills, educators will be able to increase the relevance of the classroom experience to future education and employment - in a subtle manner. On its simplest level, industries will be introduced in primary school; occupations will be the focus of middle school; all this allowing for personalized learning plans in secondary school which will promote skill awareness and acquisition. For example:

- *Industry* – the structure of industry awareness will be built around prevalence. Food, clothing, shelter, transportation, energy, waste streams, and so on – based on regional variations. Consumer expenditure data and employment by industry data will help identify the subject matter and industries to cover by region. Three levels of understanding can separate basic industries which are more "intuitive" versus complicated industries like 541 (professional and business services), insurance, and medical. Level three mastery includes calculating and explaining location quotients. Instead of a comprehensive, "one-and-done" unit on industry, the goal would be to incrementally fold in little pieces of information over a long period of time.

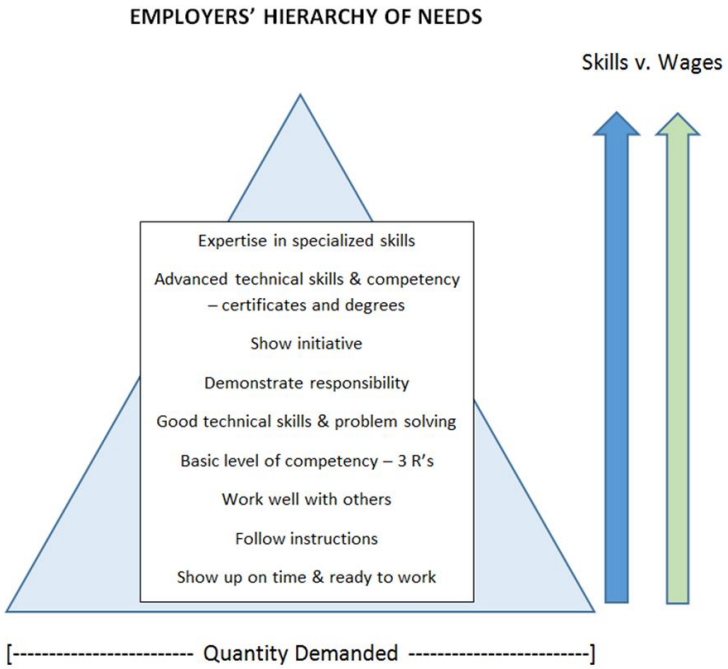
- *Occupation* – after mastery of level one industry and proficiency of level two industry awareness, the concept of occupations can be introduced. Based on current numbers of positions and openings, projected growth and wage levels, middle school students are introduced slowly to occupational exploration. First and foremost, entry level employment will

be the starting point, including a comparison between job duties, working environment, and ultimately possible career paths based on transferable skill analysis. The industry component will be brought back into discussions to reaffirm past learning.

- *Personalized Learning Plans* – the premise of all this activity is that through partial industry and career awareness, a student will be able to identify at least one area (either an industry or an occupation) which they feel passionate about. Their interests can then be focused towards skill awareness and acquisition such that their level of industry and career knowledge continues to grow but in the context of a personal plan that resonates with each student.

This becomes a "train the trainer approach" on multiple levels. By partnering with educators, their use of this approach starts the process. Next, as part of the course work, young people can be encouraged to bring the content home and present to parents, siblings, neighbors, or guardians. Community awareness of the implementation of this educational strategy will increase the likelihood that sharing of learned knowledge occurs. Articulating the content will enhance the learning process for students and further community awareness of industry, occupation, and skill information. If young people are not talking about education or careers, they are not thinking about education or careers. Furthermore, these open discussions present a clear pathway to increased partnerships with employers and encourage work place learning experiences.

One tool to help emphasize the importance of public education and tie it back to the needs of the labor market can be the "Employers' Hierarchy of Needs" (see diagram below developed by the State of Vermont based in part from employer interviews). Modeled loosely after Maslow's, this pyramid captures the essence of the skills and their relative demand from hiring employers. Students can see how their education and skills correlate to the demands of employers. The program will emphasize the relationship between skills and wages – highlighting the many skills students already possess and how they transfer to further education or employment opportunities.

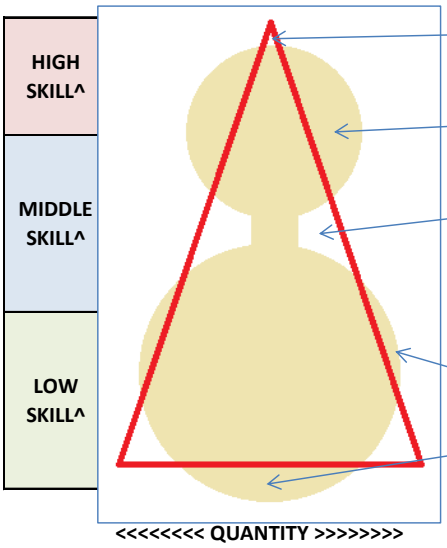


Unlike Maslow's Hierarchy, an individual can acquire skills anywhere in the pyramid at any time – skill acquisition does not need to flow from bottom to top for labor supply. In fact, young people can and are learning technical skills earlier and this has tremendous value. However, basic soft skills and work place competencies are also important. So a successful student or worker will have a mix of hard (technical) and soft skills. As evidenced by current labor market conditions across much of the country, many employers are having difficulty filling open positions at all skill levels. Much of the recent public discussion has been about a shortage of individuals with appropriate "middle skills." Below is a visual representation of this concept. It brings forward the pyramid-shape of labor demand and it overlays a visual representation of labor supply.

It is important to note that public education has been and continues to be extremely successful for many individuals. As indicated in the graphic on the following page, the bulk of individuals are well suited and prepared for their chosen field of work. This initiative seeks to continue that trend of success with improved matching based on interest. Interest created by awareness; a series of conscience decisions leading to improved outcomes… not perfect; but improved.

Simply put: the goal of this recommendation is to increase young people's understanding of their skills and how they transfer to employment post-completion of education at any level.

Labor Supply (beige) vs. Labor Demand (red) *



READER GUIDANCE

A - positions in demand requiring a combination of work experience and formal education

B - individuals with high education beyond what their current employment requires

C - visual representation of the "skills gap"; employers are demanding more middle skill workers than exist in the population; this need is filled by either individuals from B or D; each with less than optimal results

D - over supply of low skill workers

E - individuals with skills below the minimum sought by employers; these individuals experience high turnover rates and possibly face barrier(s) to employment beyond low skill

Notes

* - diagram not to scale

^ - "skill" based on formal education or/and certification

Improvement 3 – Improve Consistency and Availability of Program Evaluation Data

What: *Improve Consistency and Availability of Program Evaluation Data* by recognizing state LMI units as an appropriate entity within a state to provide program participant outcome data as specified in WIOA for select mandatory partners. Though not a requirement, this recognition would give willing state LMI units the credibility to leverage and build from. Ultimately, each state will have the option of accepting this recognition or finding an alternate entity to handle these duties.

Why: WIOA emphasizes creating awareness about the success of education and training opportunities. The recently implemented legislation lacks a stated designee to oversee the measurement of performance outcomes. Training programs provided by state entities such as Corrections, Economic Development staff, Vocational Rehabilitation, and in some cases Education lack the data to assess program outcomes. In some states, LMI units would be best suited to create performance-based outcome assessments. In addition, LMI at the state level has seen reduced levels of financial support from the federal level. This recognition as a credible and capable entity encourages state partner organizations to support the analytical work of state LMI units. It furthers the WIOA mission of closer working relationships across mandatory partners. It also avoids unnecessary duplication at the state level which depletes valuable resources by having each partner organization having to hire data staff for completing program level statistical evaluations.

How: The LMI system will be able to leverage current infrastructure in multiple ways. State level LMI has access to significant amounts of data (wage records, occupational and industry data) and the expertise. Beyond the human capital at the state level, the LMI system also has national oversight committees which can be leveraged to ensure a universal system of metrics. Using existing groups like the WIAC and the BLS Labor Market Information Oversight Committee (BLOC), the means of evaluation can be aligned to best practices.

Appendix: List of Materials

- U.S. DOL, Information Resources Management (IRM) Strategic Plan, 2014-2018
- National Association of State Workforce Agencies (NASWA), Evidence-Building Capacity in State Workforce Agencies, 2017
- Link as a starting place for many other background resources for area #1 (note that this is an Obama archive webpage); https://obamawhitehouse.archives.gov/administration/eop/ostp/divisions/cto
- See Roger Therrien 7/18/17 email to the members providing the two documents shared by meeting attendees, the link, and overview of other potential sources (provides start-up reading in one place) Note: the Obama archive link above does not go anywhere given that it is considered White House historical material; to get there, however, Google "US Chief Technology Officer" and you will find the same link which will take you there.
- 2014 DOL IT Article: http://www.cio.com/article/2599254/government-use-of-it/department-of-labor-doing-it-consolidation-centralization-amid-tight-budget.html
- DOL CIO testimony to Congress: may 18, 2016 statement of dawn marie leaf (former) chief information officer u.s. department of labor before the subcommittees on information technology and government operations committee on oversight and government reform united states house of representatives
- Some links for identifying appropriate SMEs re: DOL IT strategic planning:
  - https://www.dol.gov/oasam/ocio/ocio-org.htm
  - https://www.dol.gov/oasam/ocio/ocio-capplan.htm
  - https://www.dol.gov/oasam/ocio/ocio-itgov.htm
  - https://www.dol.gov/oasam/ocio/ocio-entarch.htm

  Perhaps, CIO Gundeep Ahluwalia or Deputy CIO Tonya Manning & Director of Advanced Technology / Systems Engineering Phil Sullivan?
- Brookings article that may help frame recommendations from job seeker POV: https://www.brookings.edu/research/meet-the-out-of-work/
- Status of states' modernization of unemployment insurance systems: http://www.itsc.org/Pages/UI-IT-Mod.aspx
- Google Cloud Jobs API/Google Hire--two main proprietary ontologies that encode knowledge about occupations and skills as well as relational models between them; occupation ontology is an enhanced evolution of the O*NET Standard Occupation Classification *https://cloud.google.com/blog/big-data/2016/11/cloud-jobs-api-machine-learning-goes-to-work-on-job-search-and-discovery (link also sent to Mr. Giancola)*
- Two documents that provide insights/information on the impact of AI on the jobs front (see Mark McKeen 9/11/17 email for actual documents).
  - Executive Office of the President, *Artificial Intelligence, Automation, and the Economy*, December 2016
  - Paysa, *Learning and the Machine* (AI Market Report)
- LMI Central within DOL/ETA Workforce GPS website: **https://lmi.workforcegps.org/**
- New web tools:
  - Launch My Career Florida **www.launchmycareerfl.org** (in conjunction with the Florida Chamber Foundation and the U.S. Chamber Foundation; uses LMI data from Florida DEO and data from Burning Glass; kickoff of this new web tool on Sept. 28)
  - Colorado and a few other states have already launched something similar; see CO for example which is already live **www.launchmycareercolorado.org**
- See also other reports/articles referenced in the document text