Getting with the Program:
Making Digital Work for City Opportunity
Digitalization and the American workforce

Mark Muro, William Frey, and Madhuri Vedpathak - November 2017

In recent decades, the diffusion of digitalization and the American workforce through the workplace, also known as "the digital revolution," has not only increased the productivity of the U.S. economy but has also contributed to a new set of technologies, such as workers' pay disparage the divergence of metropolitan economies.
1 Digitalization: What it is; why it matters
2 A new analysis and national trends
3 Implications for cities
Digitalization is the process of employing digital technology and data to transform business operations and create value

What we mean by “digitalization”
An explosion of digital tools is transforming nearly every industry.
Challenges include an IT skills shortage and limited overall digital proficiency.

Annual computer/IT college graduates versus U.S. labor market needs, 2014 - 2024

- **Computer-IT college grads**: 60,000
- **New workers needed in computer-IT industries**: 100,000

1 in 6 working-age Americans are unable to use email, web search, or other basic online tools.

Source: BLS Presentation, 2016

Source: OECD
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How we analyzed digitalization

545 occupations

91% of the U.S. labor force

Two categories of O*NET digitalization data

- Knowledge of computers and electronics
- Interaction with computers

Comprehensive digitization score from 1 to 100

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Score</th>
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<tbody>
<tr>
<td>Software developers</td>
<td>94</td>
</tr>
<tr>
<td>Electrical engineers</td>
<td>77</td>
</tr>
<tr>
<td>Lawyers</td>
<td>58</td>
</tr>
<tr>
<td>Mechanics</td>
<td>55</td>
</tr>
<tr>
<td>Registered nurses</td>
<td>55</td>
</tr>
<tr>
<td>Security guards</td>
<td>31</td>
</tr>
<tr>
<td>Restaurant cooks</td>
<td>18</td>
</tr>
<tr>
<td>Construction laborers</td>
<td>17</td>
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<tr>
<td>Personal care aides</td>
<td>14</td>
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</tbody>
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We sorted occupations by high, medium, & low digital requirements

**High**
(scores above 60)
- Software developers
- Financial Managers

**Medium**
(scores between 33 and 60)
- Registered nurses
- Office clerks

**Low**
(scores below 33)
- Construction laborers
- Personal care aides
The share of jobs requiring high & medium digital skills has skyrocketed.

Share of U.S. employment by digital skill level

- **2002**: 5% Low, 40% Medium, 56% High
- **2016**: 23% Medium, 48% High

70% in Medium or High

**Administrative support**
- 2002: 39
- 2016: 64

**Physician assistants**
- 2002: 27
- 2016: 56
Key point: Low- and medium-digital occupations have been upskilling rapidly

![Graph showing digital score progression from 2002 to 2016 for various occupations.](image-url)

- Software developers, applications
- Computer network support specialists
- Operations research analysts
- Customer service representatives
- First-line supervisors of construction trades
- Dental assistants
- Tool and die makers
- Heavy and tractor-trailer drivers
- Home health aides

Note: Bubble size reflects 2016 national employment.
Tech empowers: Digitalization brings higher wages

Average annual wage by digital score, 2016

- Low: $30 K
- Medium: $48 K
- High: $73 K
Digital “know-how” is not, however, distributed evenly

**DIGITAL SCORE:**

- **ASIAN**: 51
- **WHITE**: 48
- **BLACK**: 44
- **LATINO**: 40

**WOMEN**: 48
**MEN**: 45
Women remain underrepresented in highly digital occupations

Employment in select U.S. occupation groups by gender

Higher digital score

US Average
Computer and mathematical
Engineering
Management
Office and administrative support
Healthcare practitioner
Community and social services
Healthcare support
Transportation and material moving
Construction and extraction

Lower digital score
Non-whites are disproportionately employed in low-digital skill jobs.
Digitalization levels vary across U.S. metros

High digital employment share, 2016

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<tr>
<td></td>
<td>14.6%</td>
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<td>38.2%</td>
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Total employment, 2016 (thousands)

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<td>9,530</td>
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Higher metro digitalization is strongly correlated with higher wages

Correlation between metro mean annual wage and high digital employment share

San Jose, CA
Seattle, WA
Washington, D.C.
Salt Lake City, UT
McAllen, TX
Stockton, CA

$ R^2 = 0.4661 $
1. Digitalization: What it is; why it matters
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Most urban areas contend with two distinct digital workforce issues:

- **Opportunity jobs**: Occupations that do not require a bachelor degree but paid higher than the national mean annual wage in 2016.

- **IT jobs**: Jobs in the tech sector.

**Note:** Bubble size reflects employment in Washington-Arlington-Alexandria, DC-VA-MD in 2016; “Opportunity jobs” are occupations that do not require a bachelor degree but paid higher than the national mean annual wage in 2016.
Key fact: On-ramps to middle-class careers are rapidly upskilling

Digital skill ratings for key on-ramp occupations in Washington, D.C.

- Real estate agents: 31 → 60
- Sales representatives: 24 → 49
Cities should adopt two digital workforce training priorities

1. Expand and widen the highly digital IT talent pipeline

2. Increase basic digital literacy, especially among underrepresented groups
Cities should adopt two digital workforce training priorities

1. Expand and widen the highly digital IT talent pipeline

   • **Expand** aligned, relevant higher-ed feeder programs
   • **Scale up** non-traditional accelerated learning models, experiences, and certifications
   • **Move** toward universal K-12 CS exposure
Cities should adopt two digital workforce training priorities

2. Increase basic digital literacy, especially among underrepresented groups

- **Launch** compelling digital literacy campaigns
- **Scale-up** exposure to basic office productivity tools in school
- **Expand** entry-level tech training programs
Finally: Cultivate what is “uniquely human”

Emphasize adaptability, creativity, continuous learning, and social skills over rote information processing.
For more information:

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Digitalization
and the New Workforce Imperatives