



Centralina  
Economic Development District

Appendix C

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**Target Cluster Opportunity Analysis:  
AI/Workforce Automation Risk Assessment**  
*January 2022*

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# Target Cluster Opportunity Analysis

Technologies that automate functions currently performed by humans are poised to revolutionize the labor market. Automation will eliminate and/or fundamentally transform jobs that are routine and follow formal operating rules. At the same time, it will fuel the creation of new occupations. While the rise of automation will help maintain US economic competitiveness, it will also create significant disruptions in the labor market.

This supplemental section, AI/Workforce Automation Risk Assessment, identifies those occupations that are most at risk for automation in the Centralina Region. The assessment will also highlight the risks to occupations for each of the target industry clusters, showing which occupations are most at-risk as well as least at risk of automation. A relative comparison of automation risk of the Charlotte metro against other metros is also included.

In addition, we begin with an overview of “AI”, or Artificial Intelligence and its current and future impacts on the economy and Centralina’s target industry clusters.

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# Table of Contents

03	Summary: AI, Technology and the Transformation of Work
06	What is AI?
12	Review of AI/Workforce Automation Research
18	Workforce Automation Impact on Centralina Workers
29	Special Focus: AI in Manufacturing
32	Implications for Workforce Development
35	Possible Evolution for Economic Development Practitioners
36	Appendix

# Summary: AI, Technology and the Transformation of Work

Artificial intelligence (AI), automation, and the Internet of Things (IoT) – these are some of the disruptive technologies that are changing the world as we know it. They are reducing the friction and inefficiencies in markets. They are fostering new innovations that help people live longer, better lives. They are helping under-served parts of the world gain access to microfinancing. And they are allowing companies to develop new products and services that delight their customers.

Moreover, AI and Automation are causing significant concern about the long-term future of job creation, destruction, and transformation.

Much has been written over the last 10 years about the future of work, but few could disagree with the following statement:

**“Almost no occupation will be unaffected by the adoption of currently available technologies.”**

**-- Brookings**

In past years, workforce automation has been driven by investment in robotics in the manufacturing sector. Manufacturing automation has contributed in a multi-decade decline in employment in the US as well as in developing countries such as China and India. While some US-based and NC-based industries suffered de-investment due to global offshoring and automation (for example, textiles), the future of automation will be more of a “human + machines” model, where technically trained individuals work directly with machines to make decisions, optimize workflows, and ultimately create better and less expensive products per worker (i.e. heightened worker productivity).

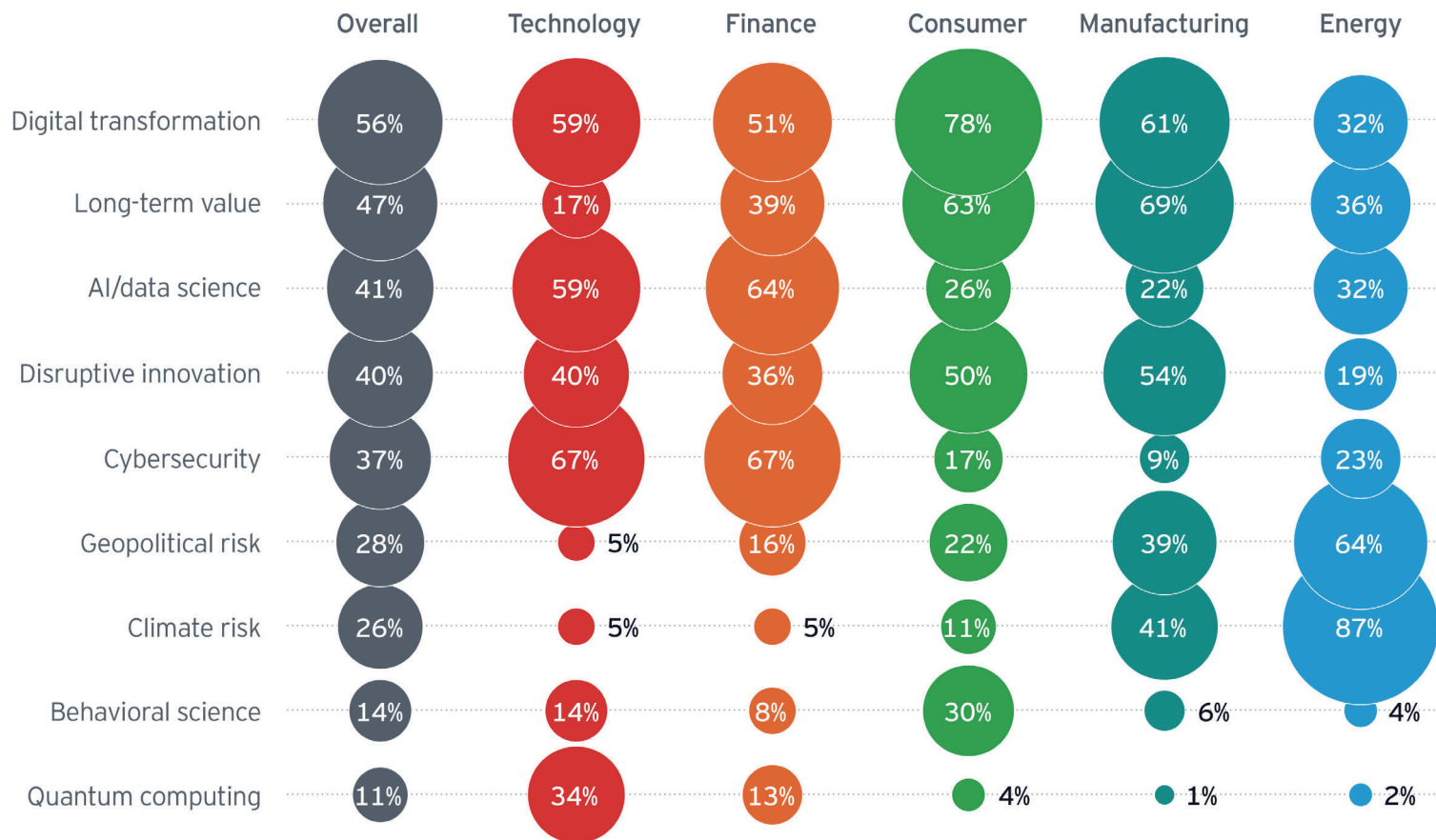
**“Fears of job losses have to be seen in context. People should think about AI augmenting the human ability, not about AI replacing jobs.”**

**-- Dr. Jeff Welser, VP and Lab Director at IBM Research via EY**

# Summary: AI, Technology and the Transformation of Work

AI strategies are now prevalent across Corporate America. According to the EY CEO Imperative Study, 63% of Forbes Global 2000 chief executives view technology and digital innovation as one of the top trends impacting their company. Among CEOs, digital transformation ranks as the top business concern among CEOs.

## Areas of increased C-suite focus to drive growth



Respondents could select up to three areas.  
Source: EY CEO Imperative Study 2021.

[Link](#)

# Summary: AI, Technology and the Transformation of Work

The implementation of AI will be highly highly dependent on the availability of technology workers and the skills of the incumbent workforce to adopt and train new AI-based systems. In a survey of 200 senior leaders pre-pandemic, EY found that 56% see talent shortages as the single biggest barrier to implementing AI into business operations. This high percentage was a large jump from 36% reporting just four months prior. The pandemic, new labor shortages, and acceleration of technology adoption will create an even bigger gap between the availability technologies and workers who can use them.

**“AI is likely to create winners and losers, and those who start adopting the technology early stand to be at a significant advantage.”**

**-- Nigel Duffy, EY Global Innovation AI Leader**

**“Developing professional certification, compliance monitoring, and oversight programs for AI – and the auditing expertise their execution will require – will be a crucial societal project .”**

**- Eric Schmidt and Henry Kissinger (Age of AI)**

The biggest risk is non-adoption. Every challenge in the world, and in business in particular, is an opportunity for AI. Adopting AI will require patience and a willingness to learn, and will be complex and lengthy, so firms need to start now. Many early projects will have a low return on investment (ROI) and a limited impact – they primarily provide learning opportunities. But that learning is essential and the first step on a transformational journey that will touch every business (and community).

# First, What is AI?

In the recent book “Age of AI”, Henry Kissinger, Eric Schmidt and Daniel Huttenlocker provide a rather profound answer to the question, “What is AI?”:

“AI is not an industry, let alone a single product. In strategic parlance, it is not a “domain. ” It is an enabler of many industries and facets of human life : scientific research, education, manufacturing, logistics, transportation, defense, law enforcement, politics, advertising, art, culture, and more. The characteristics of AI – including its capacities to learn, evolve , and surprise – will disrupt and transform them all. The outcome will be the alteration of human identity and the human experience of reality at levels not experienced since the dawn of the modern age.” -- Age of AI

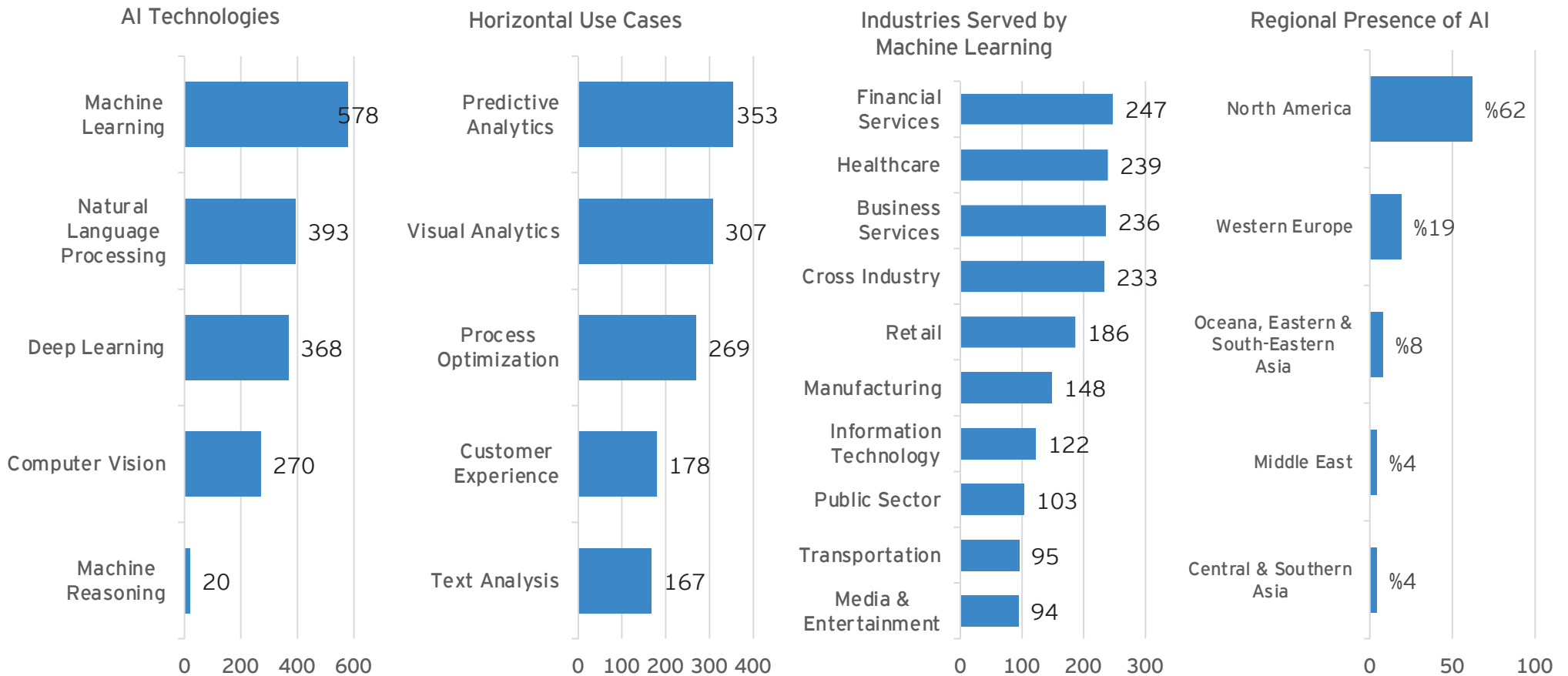
Eric Schmidt, in a recent interview, offered a simpler answer:

“It’s a system that gets better through learning. It’s a system of knowledge implemented inside the cloud. It’s very good at looking at large datasets and predicting things. It’s very good at finding patterns that humans can’t see (and may not understand.)”

-- Eric Schmidt, former CEO of Google, 2021 (podcast)

# Types of AI

Today, most forms of AI are characterized in terms of Machine Learning, Natural Language Processing, Deep Learning and Computer Vision. AI is used for Predictive Analytics, Visual Analytics (of images), Process Optimization, and Customer Experience (such as chatbots).



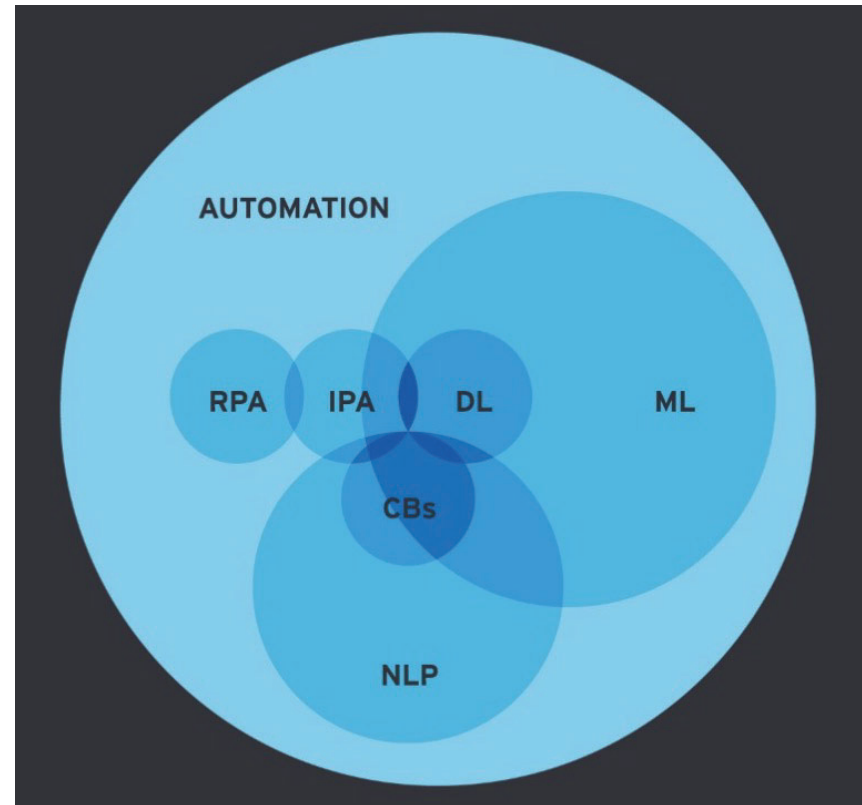
Source: Omdia



# Review of Common Automation Terms

- **Automation:** Technology that performs human-like tasks.
- **Chatbots (or CBs):** Software that mimics conversations with humans.
- **Deep learning (or DL):** Algorithms inspired by the structure and function of the brain that learn to recognize patterns in digital representations of sounds, images and other data.
- **Intelligent process automation (or IPA):** Technology that combines robotic process automation and machine learning; mimics human activities and learns from them to improve without needing human intervention.
- **Robotic process automation (or RPA):** Software or robotics that mimic the actions of a human.
- **Machine learning (or ML):** Algorithms programmed to learn for themselves using data.
- **Natural language processing (or NLP; includes natural language generation):** Software that understands, analyses and synthesizes natural language and speech.

Overlapping Technologies in Automation



Source: [EY Intelligent Automation](#)

# Where is AI Found in Centralina's Target Industries?

AI technologies are too numerous to list but are already integrated into the daily lives of most people, oftentimes without people knowing they are interacting with AI. AI can be as simple as helping us fill in our Internet searches to complex tasks such as helping doctors identify cancer in X-rays. Much has been touted about the future of AI-powered autonomous vehicles (with billions of dollars spent on research) but many instances of AI are more augmentation to assist workers such as identifying pallets in transport or risks in mortgage applications. Some sample uses cases of AI include:



ADVANCED  
MANUFACTURING



FINANCIAL &  
PROFESSIONAL  
SERVICES



LIFE SCIENCES &  
HEALTHCARE



INFORMATION  
TECHNOLOGY



LOGISTICS &  
DISTRIBUTION

*Sample uses cases:*

- |  |   |   |  |  |
|--|---|---|--|--|
| <ul style="list-style-type: none"><li>• Robots</li></ul>               | <ul style="list-style-type: none"><li>• Fintech</li></ul>                     | <ul style="list-style-type: none"><li>• Drug discovery</li></ul>    | <ul style="list-style-type: none"><li>• Big Data Analytics</li></ul>     | <ul style="list-style-type: none"><li>• Robots</li></ul>               |
| <ul style="list-style-type: none"><li>• Industry 4.0</li></ul>         | <ul style="list-style-type: none"><li>• Risk assessment</li></ul>             | <ul style="list-style-type: none"><li>• Health monitoring</li></ul> | <ul style="list-style-type: none"><li>• AI adoption</li></ul>            | <ul style="list-style-type: none"><li>• Augmented Reality</li></ul>    |
| <ul style="list-style-type: none"><li>• Inventory management</li></ul> | <ul style="list-style-type: none"><li>• High volume loan approvals</li></ul>  | <ul style="list-style-type: none"><li>• Diagnostics</li></ul>       | <ul style="list-style-type: none"><li>• Data Center automation</li></ul> | <ul style="list-style-type: none"><li>• Autonomous trucking</li></ul>  |
| <ul style="list-style-type: none"><li>• Energy reduction</li></ul>     | <ul style="list-style-type: none"><li>• Customer service / chatbots</li></ul> |   | <ul style="list-style-type: none"><li>• Energy reduction</li></ul>       | <ul style="list-style-type: none"><li>• Inventory management</li></ul> |

# AI: Why Now?

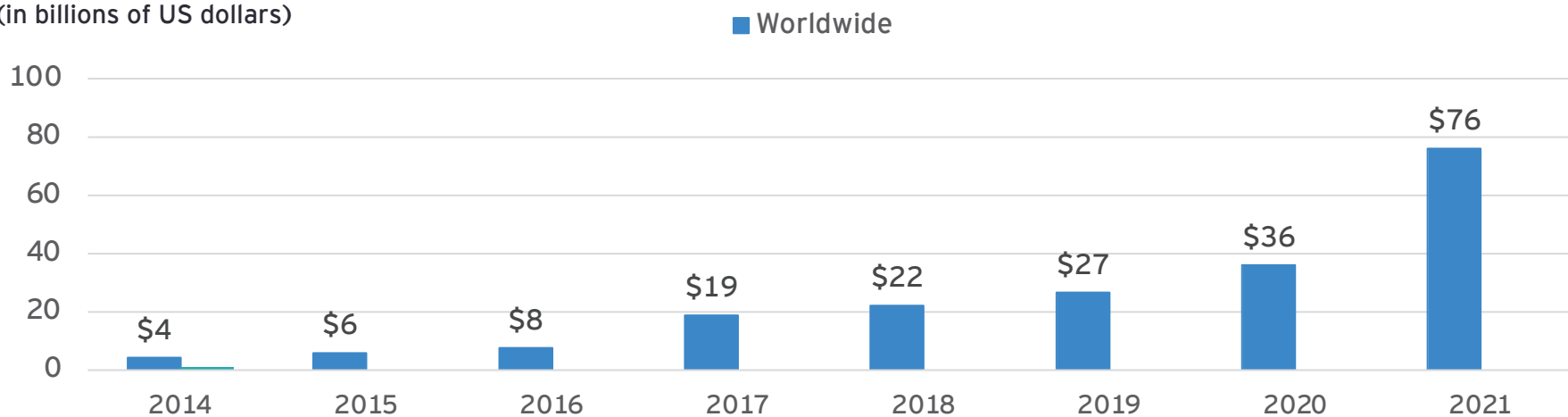
AI has spent many years as a “nascent” industry, but as technologies, knowledge, and workforce capabilities improve, AI adoption appears to be on a growth curve significantly more exponential than previous technologies - and its impact will be far and wide..

Consider the venture capital investments in AI companies as a proxy for growth. Let's consider startup venture capital in AI. In 2020, over \$71 billion dollars was invested in AI startups, with a 10x increase in 5 years in the US alone. China has openly stated that it will invest heavily in AI as leap-frog opportunities to achieve heightened levels of economic and geopolitical success.

## Venture Capital Investments in AI in 2020

- \$38B in US - a 10x increase in 5 years
- \$25B in Asia
- \$8B in Europe

AI startup company funding worldwide 2014-2021  
(in billions of US dollars)



Source: [Statista](#), AI startup company funding worldwide 2014-2021  
Note: 2021 data is estimate based on 6 mo figure.

# Examples of AI Companies, Use Cases, and Quotes

Company	Key Information
OpenAI	<ul style="list-style-type: none"> <li>Formed in 2015 with \$1B investment from small group including Elon Musk.</li> <li>Received \$1B investment from MSFT in 2019.</li> <li>Plans to make patents and technology "open source" for public domain.</li> <li>In June 2020, OpenAI announced GPT-3, a language model trained on trillions of words from the Internet.</li> <li>GPT-3 is aimed at natural language answering of questions.</li> <li>Demonstrated how they can control MS Word through MSFT's API and NLP commands</li> <li>Believes "Artificial General Intelligence" (AGI) may happen in 10 years (versus task-specific AI today)</li> </ul>
Moderna	<p>"AI is a platform...we are injecting it in everything we do." -- Moderna CIO (podcast)</p> <ul style="list-style-type: none"> <li>Founded 10 years ago and developed the systems to enable rapid development of mRNA vaccines.</li> <li>Funded with \$2.5B, Moderna revenue grew from \$100M in 2014 to \$15B in 2021.</li> <li>Its AI platform enabled the rapid development of its Covid-19 vaccine.</li> </ul>
Cooper Standard (Auto parts supplier)	<p>"We spent a lot of time and money coming up with advanced polymer formulations. A lot of it historically has been trial and error. That's what industrial chemists often do. We used AI to develop a system that advises our chemists on the next set of recipes to try as we iterate to a final solution. We found dramatic reductions, in many cases, with that approach, reducing R&amp;D loops 70-80%."</p>
DHL	<p>"The first day is the worst day for AI [adoption]." - Gina Chung, VP, Innovation Americas (Talking about their use of AI visual analytics to manage pallets)</p>
Salesforce	<p>"AI is the automation of human intelligence." - Paula Goldman, Chief Ethical and Humane Use Officer</p>
Mastercard	<p>"We are at AI 1.5" - JoAnn Stonier, Chief Data Officer (an indication that AI is beyond early stage but has significantly more room to grow)</p>

# Review of AI/Workforce Automation Research

Workforce automation and the impact (loss) on jobs has been a conversation for decades since the 1960s. More recently, and pre-pandemic, national conversations focused on the findings of an Oxford University study that estimated that 47% of all work tasks economy-wide are at risk of automation due to their repetitive or “routine-based” nature:

- A 2013 report by Oxford University estimated that 47% of US jobs are at risk of automation
  - The Future of Employment: How Susceptible Are Jobs To Computerisation?
  - Summary: <https://www.oxfordmartin.ox.ac.uk/blog/automation-and-the-future-of-work-understanding-the-numbers/>
  - Analysis was based on the US O\*NET database of tasks by occupation compiled by US BLS surveys; authors state that AI (machine learning) was used to do the analysis.
  - Note that their estimate of 47% represents the percentage of work that is “routine” and “computerizable”, and therefore automatable.

# Review of AI/Workforce Automation Research

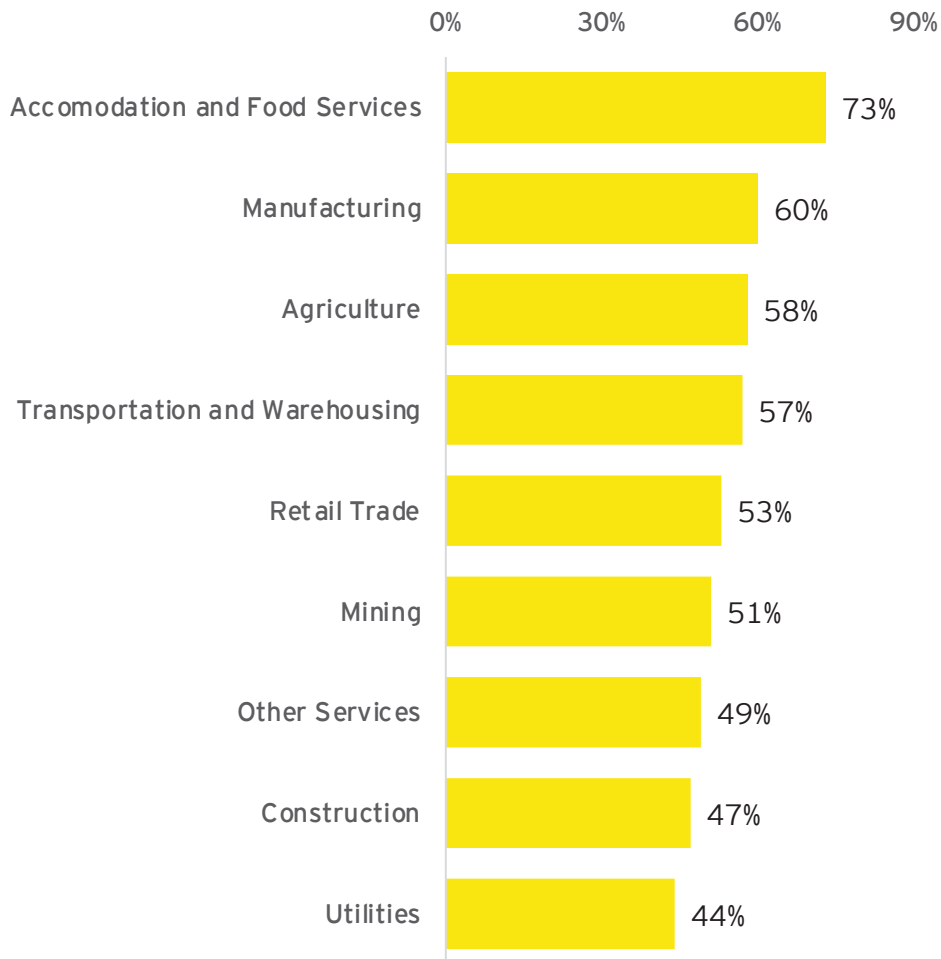
Numerous other studies followed, including a 2018 OECD study that did a similar comparison and identified 14% of jobs as “highly vulnerable” and another 32% had above-average threat, with a probability of 50-70%. As a result, a similar 46% of jobs were determined to be automatable. Some other leading reports that received significant media coverage include:

- Oxford Economics estimated in 2018 that 20M manufacturing jobs would be lost worldwide by 2030 due to investments in robots (1.5M in US; 14M in China)
- McKinsey in 2017 performed a similar analysis of work activities to determine:
  - Nearly 50% of activities have the potential to be automated using today's technology
  - Only 5% of jobs can be fully automated, but 60% of occupations have the potential for 30% or more for automation

# Industries Most Prone to Automation

McKinsey's analysis identified automation risk by industry and the functions that were most likely or least likely to be automated. Hospitality/Restaurants, Manufacturing, and Agriculture topped the list.

Automation Potential by Industry



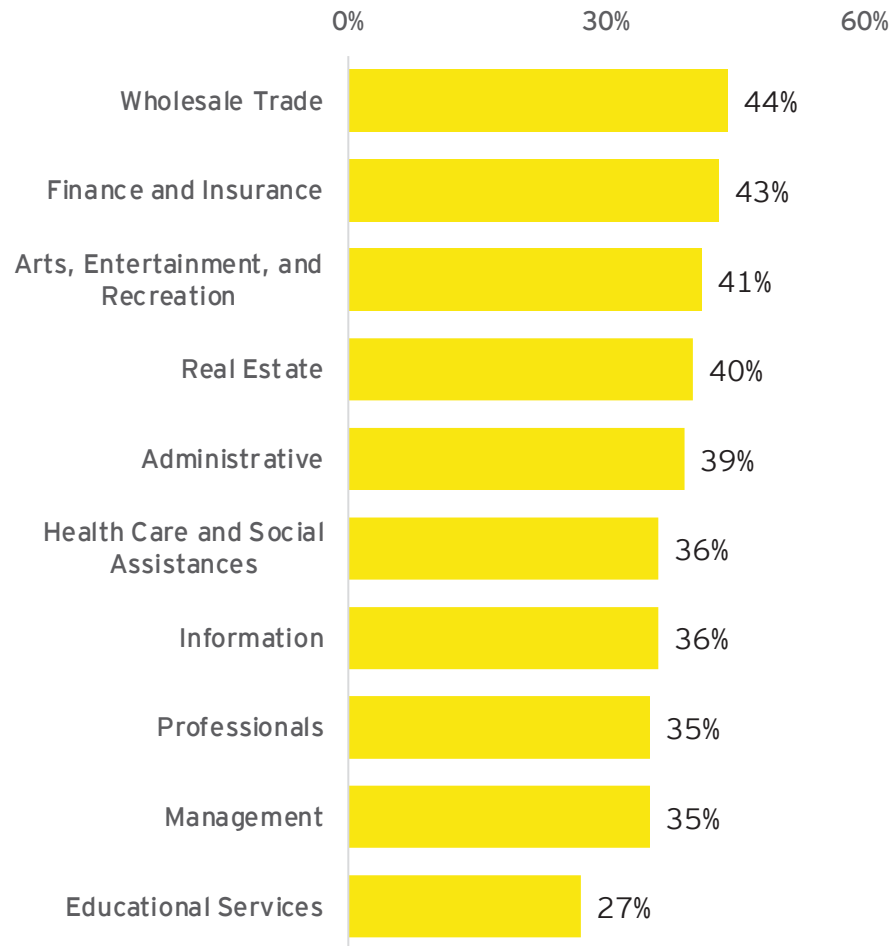
Function most likely to automate	Function least likely to automate
Predictable physical	Customer interface
Predictable physical	Expertise and unpredictable physical
Collect data and predictable physical	Unpredictable physical
Collect data and predictable physical	Unpredictable physical and interface
Process data and predictable physical	Interface
Predictable physical and collect data	Expertise and unpredictable physical
Predictable physical	Manage and interface
Predictable physical and collect data	Unpredictable physical and expertise
Collect data	Unpredictable physical

Source: EY analysis of McKinsey

# Industries Least Prone to Automation

Results showed that the industries least susceptible to automation include Education, Management, and Professional Services. These industries require significant interaction with customers and the use of expertise, though AI/Machine Learning is quickly moving into highly analytical roles.

Automation Potential by Industry



Function most likely to automate	Function least likely to automate
Collect data	Interface
Process data	Expertise and interface
Predictable physical	Unpredictable physical and expertise
Process data	Unpredictable physical and interface
Collect data	Unpredictable physical
Process data	Interface and expertise
Collect data	Interface and expertise
Process data	Interface and expertise
Process data	Interface and expertise
Process data	Management, expertise, and interface

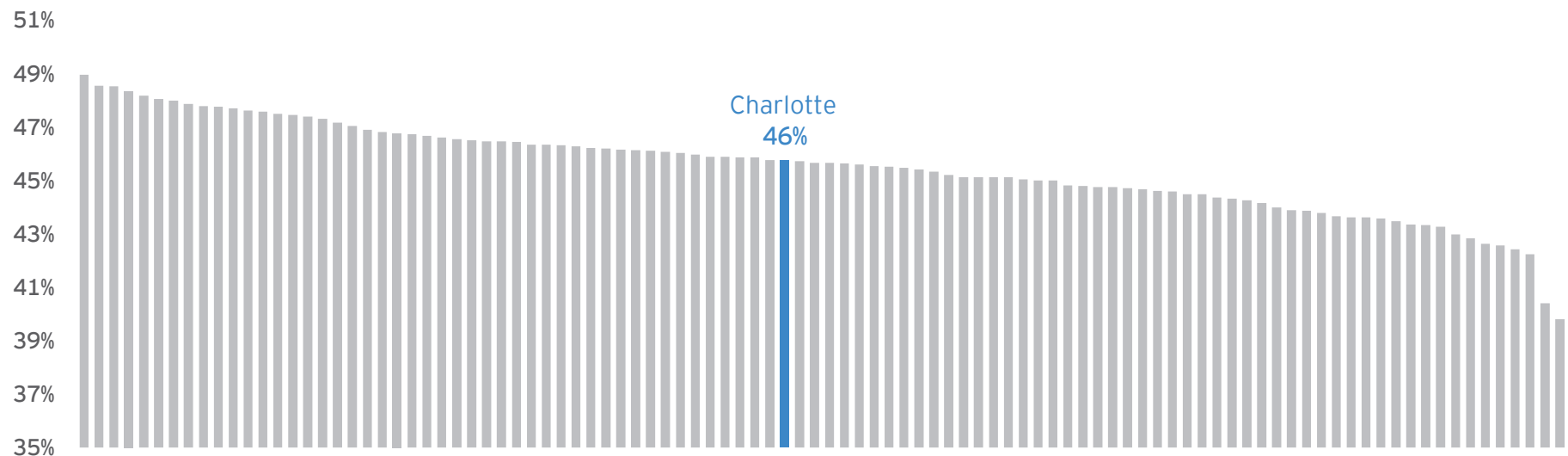
Source: EY analysis of McKinsey



# Brookings' estimate of Automation Risk by Metro

The Brookings Institute performed an analysis based on the Oxford data to determine the level of automation risk to US metros. Charlotte ranks 49<sup>th</sup> out of the top 100 metros in the US for “automation potential” - situated in the middle. Across metros of all sizes, Charlotte ranks at the 25<sup>th</sup> percentile (with 100 being highest automation potential). This is an indication that many smaller metros have a higher risk for automation than larger, more diversified metros.

Average Potential Automation of Metro Job Base



Source: Brookings

## Top 5 Large Metros for Automation Risk:

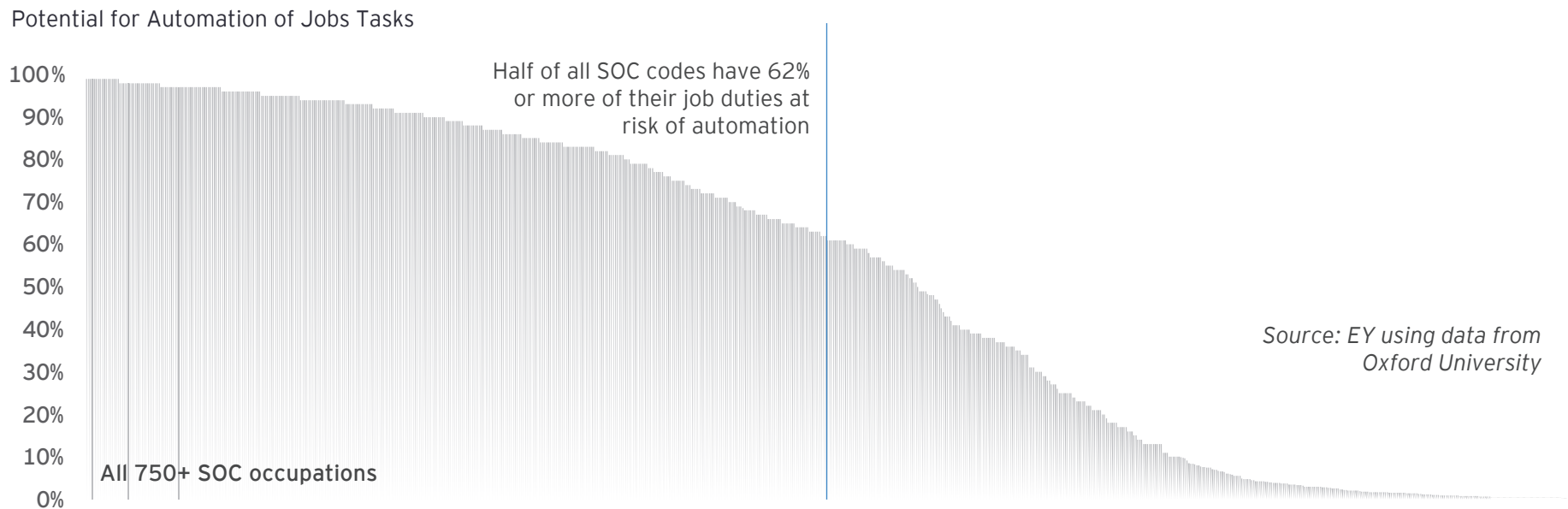
- Toledo, OH
- Greensboro-High Point, NC
- Lakeland-Winter Haven, FL
- Stockton-Lodi, CA
- Las Vegas-Henderson-Paradise, NV

## Bottom 5 Large Metros for Automation Risk:

- Washington-Arlington-Alexandria, DC-VA-MD-WV
- San Jose-Sunnyvale-Santa Clara, CA
- New York-Newark-Jersey City, NY-NJ-PA
- Durham-Chapel Hill, NC
- Boston-Cambridge-Newton, MA-NH

# Oxford's estimate of Automation Risk by Occupation

Oxford's analysis utilized machine learning to assess the likelihood of automation risk for over 700 occupations. Due to their use of SOC codes from 2010, EY extended their assessment to new or changed occupation codes through 2020 SOC taxonomy changes. Below is a graph that shows all occupations according to their "computerizable" index from 0% to 100%. Important: Data shows how much of a job could be automated. Higher automation potential implies either job losses and/or significant use new technologies to boost productivity.



## Top Occupations for Highest Automation Risk:

- Accounts Clerks
- Data Entry Keyers
- Librarians and Library Technicians
- Insurance Underwriters
- Tax Preparers
- Financial and Investment Analysts

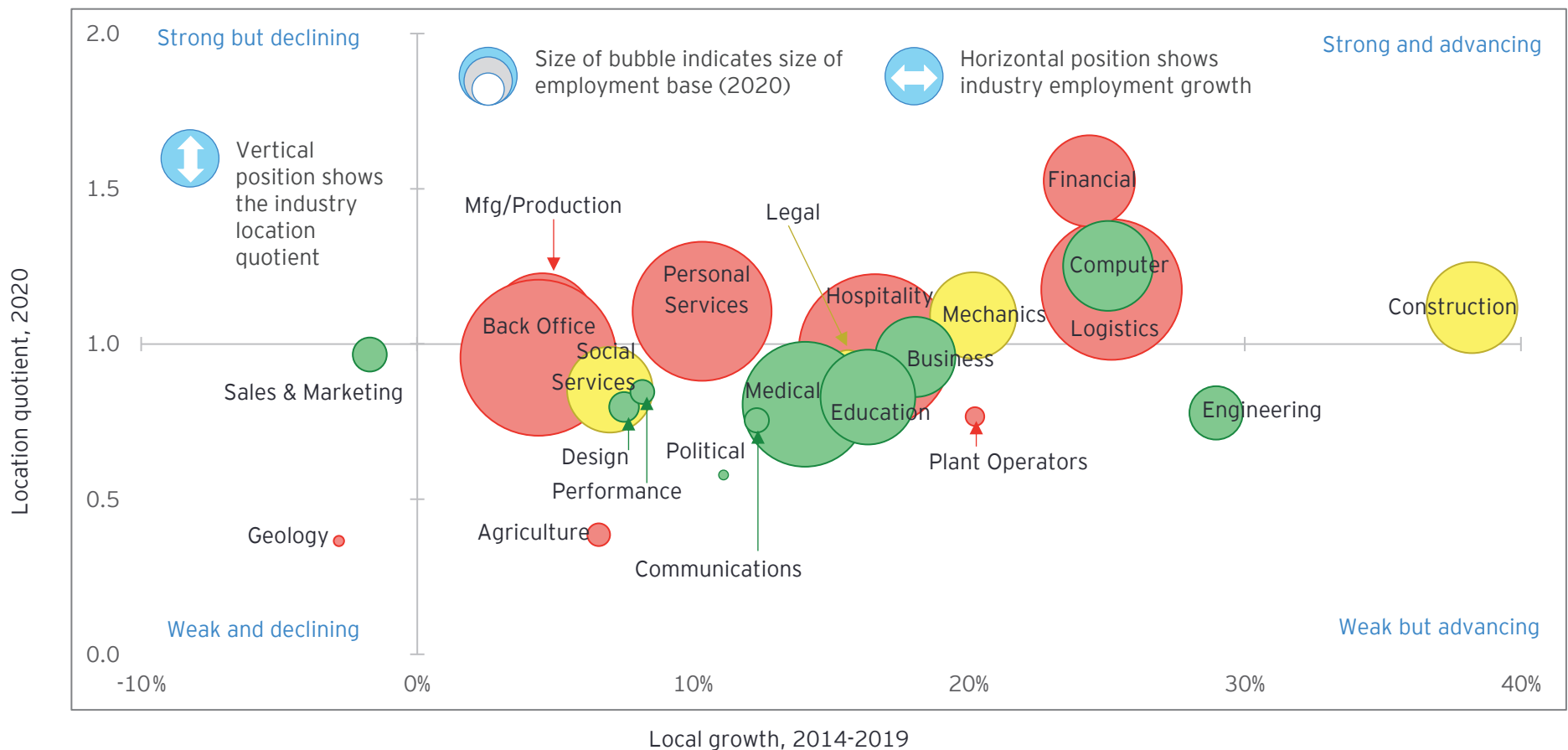
## Top Occupations for Lowest Automation Risk:

- Recreational Therapists
- Emergency Management Directors
- Supervisors of Mechanics
- Mental Health Workers
- Occupational Therapists
- Orthotists and Prosthetists
- Healthcare Social Workers

# Workforce Automation Impact on Centralina Workers

Specific to the Charlotte region, EY produced an analysis of occupation clusters that uses Oxford's automation risk factor for individual occupations. EY aggregated the risk factors by occupation cluster to provide a weighted index to show where automation is most likely to occur. Back Office, Hospitality, Personal Services, Logistics, and Mfg/Production occupations (not industries) show the highest risk of automation.

Centralina Occupation Cluster Analysis for Automation Risk



Source:  
EY analysis of EMSI (only clusters with more than 50 jobs are shown).

RISK OF AUTOMATION: ● Above Average ● Average ● Below Average

# Workforce Automation Impact on Centralina Workers

The data in the following table reflects the previous slide's bubble chart:

Workforce automation impact on Centralina workers

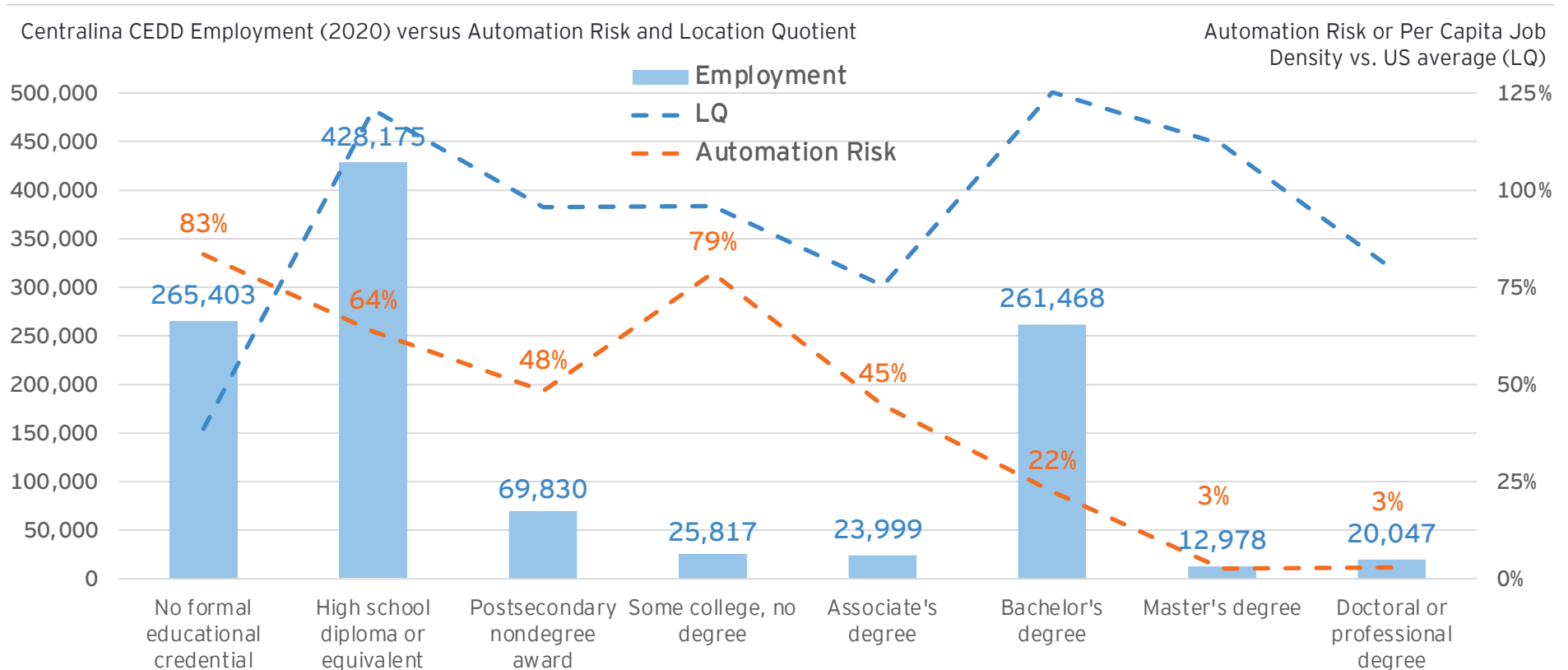
Cluster	Employment ('19)	Employment growth ('14-'19)	LQ ('19)	% Risk of Automation	Cluster	Employment ('19)	Employment growth ('14-'19)	LQ ('19)	% Risk of Automation
Agriculture	3,350	6.6%	0.4	74.9%	Legal	8,039	15.6%	0.9	47.1%
Architecture	1,664	45.5%	1.2	23.1%	Logistics	122,883	25.1%	1.2	67.8%
Back Office	151,150	4.4%	1.0	71.6%	Math	2,111	70.6%	1.3	18.6%
Business	40,174	18.0%	1.0	23.2%	Mechanics	46,645	20.1%	1.1	58.3%
Communications	3,835	12.3%	0.8	18.7%	Medical	97,018	14.0%	0.8	23.4%
Computer	50,433	25.0%	1.3	15.5%	Performance	3,714	8.2%	0.8	77.2%
Construction	51,777	38.6%	1.1	54.6%	Personal Services	120,167	10.3%	1.1	19.8%
Design	5,682	7.5%	0.8	24.3%	Plant Operators	2,291	20.2%	0.8	8.2%
Education	56,086	16.3%	0.8	14.7%	Political	584	11.1%	0.6	17.7%
Engineering	17,974	28.9%	0.8	18.8%	Production	71,062	4.5%	1.1	76.1%
Financial	52,020	24.3%	1.5	66.6%	Sales & Marketing	7,394	-1.7%	1.0	73.7%
Geology	742	-2.8%	0.4	81.1%	Social Service	45,927	7.0%	0.9	35.6%
Hospitality	144,996	16.6%	1.0	77.6%	<b>Total</b>	<b>1,107,732</b>	<b>15.1%</b>	<b>1.0</b>	<b>55.8%</b>

Sources: EY, EMSI, Oxford University

# Automation Risk by Education Level

Not surprisingly, lower-skill jobs that are repetitive or prone to machinery displacement are at highest risk. In the chart below, EY provides data on Centralina jobs by education level (blue bars) and location quotient (blue dotted line). The location quotient is also provided (orange dotted line). Oxford's automation data is translated into a weighted average across all jobs in each education level.

With the Centralina region, the most jobs at risk of automation are those requiring No Formal Education (83% of jobs are at risk) or those requiring a High School Diploma (64%). Combined, nearly 700,000 people are employed in these at-risk jobs. It is important to note that education levels are "Required Entry Level Education" from the ONET system. Some workers will advance their education within their role, or others will be overqualified for their job. As shown by the blue dotted line, High School level jobs are oversupplied in the Centralina economy (LQ=1.21) as are Bachelor's jobs (LQ=1.25). Bachelor's level jobs comprise about 27% of all jobs in the Centralina region (though the workforce have a relatively low risk of automation). By our estimation, 57% of all jobs (FTE) are at risk of automation in the Centralina region.

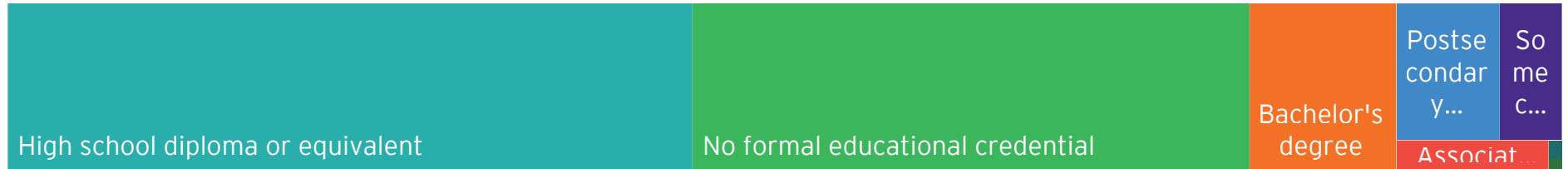


Source: EY using data from EMSI and Oxford

# Top Occupations for Automation Risk by Education Level

Below, we provide the occupations with the 1) highest number of FTE jobs at risk and 2) have 80% or more of their job tasks that are prone to automation. For example, while High School diploma jobs employ 428,000 people in the Centralina region, its 64% automation risk factor results in a full-time equivalent of 272,000 jobs at risk to automation - the highest of all education levels.

Centralina CEDD Total Jobs at Risk by Education level



## High School Diploma: 272,000 Jobs at Risk

Sales Reps, 93%, 22k  
 Office Clerks, 96%, 19k  
 Assemblers and Fabricators, 97%, 14k  
 Secretaries, 91%, 14k  
 Receptionists, 96%, 9k  
 Security Guards, 84%, 7k  
 Driver/Sales Workers, 98%, 5k  
 Shipping Clerks, 98%, 5k  
 Inspectors, Testers, 98%, 4k  
 Insurance Sales Agents, 92%, 3k  
 Passenger Vehicle Drivers, 89%, 3k  
 Operating Engineers, 95%, 3k  
 Billing and Posting Clerks, 96%, 3k  
 Claims Adjusters, 98%, 3k  
 Welders, 94%, 3k

## Some College: 20,000 Jobs at Risk

Bookkeeping Clerks, 98%, 11k  
 Order Clerks, 98%, 870

## No Education: 221,000 Jobs at Risk

Fast Food Workers, 96%, 30k  
 Retail Salespersons, 92%, 30k  
 Cashiers, 97%, 29k  
 Laborers/Material Movers, 85%, 23k  
 Waiters, 94%, 19k  
 Cooks, Restaurant, 89%, 18k  
 Landscaping Workers, 95%, 7k  
 Construction Laborers, 88%, 6k  
 Industrial Truck Operators, 93%, 6k  
 Food Preparation Workers, 87%, 4k  
 Hosts, Restaurant, 97%, 4k  
 Counter/Rental Clerks, 97%, 3k  
 Refuse Collectors, 93%, 2k  
 Parts Salespersons, 98%, 2k  
 Ushers / Ticket Takers, 96%, 2k

## Associate's: 11,000 Jobs at Risk

Paralegals, 94%, 3020  
 HR Assistants, 90%, 810  
 Electronics Drafters/Technicians, 83%, 610  
 Legal Support Workers, Misc, 94%, 170  
 Nuclear Technicians, 85%, 120

## Bachelor's: 59,000 Jobs at Risk

Accountants and Auditors, 94%, 11k  
 Financial Analysts, 99%, 6k  
 Human Resources Specialists, 95%, 5k  
 Loan Officers, 98%, 5k  
 Credit Analysts, 98%, 1k  
 Insurance Underwriters, 99%, 1k  
 Librarians, 99%, 1k

## Certificate: 34,000 Jobs at Risk

Library Technicians, 99%, 660  
 Manicurists and Pedicurists, 95%, 510  
 Tool and Die Makers, 84%, 320  
 Prepress Technicians, 97%, 160  
 Barbers, 80%, 120  
 Electronics Repairers (Transport), 91%, 110  
 Medical Transcriptionists, 89%, 110

## Advanced: 900 Jobs at Risk

No occupations are above 80% threshold

Source: EY analysis of Oxford and EMSI data

# Automation Risk for Jobs in Centralina Target Industry Clusters

On the following pages, EY provides an analysis of job impacts likely due to automation for Centralina's five target industry clusters:



ADVANCED  
MANUFACTURING



FINANCIAL &  
PROFESSIONAL  
SERVICES



LIFE SCIENCES &  
HEALTHCARE



INFORMATION  
TECHNOLOGY



LOGISTICS &  
DISTRIBUTION

The NAICS definition for each target cluster is provided at the end of this section of the report.

EY pulled staffing patterns from EMSI for an aggregated cluster definition that provided jobs by occupation, growth trends, wage levels, and education levels. The Automation Risk % is the "computerizable" ratio from the Oxford University research.

# Advanced Manufacturing Target: Top Jobs Most at Risk

SOC	Description	Jobs at Risk	Automation Risk %	2019 Jobs	% Chg, '14-'19	Median Hourly Earnings	Ed Level
51-2098	Miscellaneous Assemblers and Fabricators	6,143	97%	6,333	6%	\$15.40	HS
53-7062	Laborers and Freight, Stock, and Material Movers, ...	2,358	85%	2,774	69%	\$14.14	None
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighe...	2,107	98%	2,150	17%	\$18.74	HS
51-9111	Packaging and Filling Machine Operators and Tender...	1,983	98%	2,024	71%	\$14.06	HS
51-4072	Molding, Coremaking, and Casting Machine Setters, ...	1,967	95%	2,071	40%	\$20.38	HS
51-4121	Welders, Cutters, Solderers, and Brazers	1,820	94%	1,936	62%	\$20.62	HS
41-4012	Sales Representatives, Wholesale and Manufacturing...	1,595	85%	1,876	26%	\$34.30	HS
51-4041	Machinists	1,432	65%	2,203	-7%	\$22.75	HS
51-9023	Mixing and Blending Machine Setters, Operators, an...	1,278	83%	1,540	22%	\$18.53	HS
43-5071	Shipping, Receiving, and Inventory Clerks	1,143	98%	1,167	-4%	\$16.95	HS
51-4031	Cutting, Punching, and Press Machine Setters, Oper...	1,106	78%	1,418	11%	\$16.99	HS
53-7051	Industrial Truck and Tractor Operators	1,009	93%	1,085	-20%	\$17.18	None
51-9198	Helpers--Production Workers	965	66%	1,462	-26%	\$13.75	HS
43-9061	Office Clerks, General	891	96%	928	28%	\$16.92	HS
49-9041	Industrial Machinery Mechanics	870	67%	1,298	43%	\$26.19	HS
53-3032	Heavy and Tractor-Trailer Truck Drivers	832	79%	1,053	13%	\$22.00	Certificate
49-9071	Maintenance and Repair Workers, General	779	64%	1,217	6%	\$21.71	HS
51-9041	Extruding, Forming, Pressing, and Compacting Machi...	723	93%	777	3%	\$17.89	HS
51-2028	Electrical, Electronic, and Electromechanical Asse...	623	95%	656	-11%	\$15.26	HS
13-2011	Accountants and Auditors	598	94%	637	28%	\$39.73	Bachelor's
51-4021	Extruding and Drawing Machine Setters, Operators, ...	595	91%	654	-42%	\$20.57	HS
51-4033	Grinding, Lapping, Polishing, and Buffing Machine ...	588	95%	619	-33%	\$19.23	HS
43-3031	Bookkeeping, Accounting, and Auditing Clerks	585	98%	597	23%	\$20.34	Some Coll
51-9011	Chemical Equipment Operators and Tenders	575	76%	757	30%	\$24.04	HS
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	542	94%	576	22%	\$14.00	None
51-9124	Coating, Painting, and Spraying Machine Setters, O...	534	91%	587	-8%	\$22.34	HS
53-7064	Packers and Packagers, Hand	498	38%	1,312	-6%	\$12.14	None
43-4051	Customer Service Representatives	474	55%	861	3%	\$18.18	HS
43-5061	Production, Planning, and Expediting Clerks	457	88%	520	11%	\$23.23	HS
43-6014	Secretaries and Administrative Assistants, Except ...	450	96%	469	24%	\$19.08	HS
51-3011	Bakers	371	89%	417	44%	\$12.11	None
49-9043	Maintenance Workers, Machinery	365	86%	424	-18%	\$22.76	HS
51-7011	Cabinetmakers and Bench Carpenters	357	92%	388	-3%	\$17.82	HS
13-1071	Human Resources Specialists	351	95%	370	78%	\$30.75	Bachelor's
51-7042	Woodworking Machine Setters, Operators, and Tender...	341	97%	351	18%	\$13.90	HS

For occupations employing more than 340 workers.



# Financial & Professional Services: Jobs Most at Risk

SOC	Description	Jobs at Risk	Automation Risk %	2019 Jobs	% Chg, '14-'19	Median Hourly Earnings	Ed Level
13-2011	Accountants and Auditors	4,901	94%	5,213	33%	\$39.73	Bachelor's
13-2072	Loan Officers	4,578	98%	4,672	24%	\$36.49	Bachelor's
43-4051	Customer Service Representatives	4,008	55%	7,287	8%	\$18.18	HS
13-2098	Financial and Investment Analysts, Financial Risk ...	3,446	99%	3,481	37%	\$45.71	Bachelor's
41-3021	Insurance Sales Agents	3,429	92%	3,728	33%	\$26.66	HS
43-3031	Bookkeeping, Accounting, and Auditing Clerks	2,688	98%	2,743	35%	\$20.34	Some Coll
43-4131	Loan Interviewers and Clerks	2,020	92%	2,196	10%	\$23.69	HS
13-1031	Claims Adjusters, Examiners, and Investigators	1,992	98%	2,032	42%	\$33.21	HS
43-9061	Office Clerks, General	1,960	96%	2,042	0%	\$16.92	HS
43-3071	Tellers	1,885	98%	1,924	-19%	\$16.83	HS
13-2052	Personal Financial Advisors	1,597	58%	2,754	31%	\$55.35	Bachelor's
43-6014	Secretaries and Administrative Assistants, Except ...	1,405	96%	1,464	-1%	\$19.08	HS
43-9041	Insurance Claims and Policy Processing Clerks	1,270	98%	1,296	6%	\$21.99	HS
13-2053	Insurance Underwriters	1,139	99%	1,151	40%	\$37.02	Bachelor's
13-2041	Credit Analysts	1,106	98%	1,128	26%	\$43.54	Bachelor's
43-4011	Brokerage Clerks	1,053	98%	1,075	24%	\$27.28	HS
41-3091	Sales Representatives of Services, Except Advertis...	760	99%	768	22%	\$24.65	HS
43-3021	Billing and Posting Clerks	661	96%	689	30%	\$18.31	HS
13-1071	Human Resources Specialists	644	95%	678	84%	\$30.75	Bachelor's
43-4171	Receptionists and Information Clerks	632	96%	659	59%	\$15.12	HS
13-1161	Market Research Analysts and Marketing Specialists	599	61%	982	61%	\$32.14	Bachelor's
43-6011	Executive Secretaries and Executive Administrative...	578	86%	672	-41%	\$31.24	HS
13-2082	Tax Preparers	542	99%	548	35%	\$12.72	HS
43-3011	Bill and Account Collectors	537	95%	565	-47%	\$19.47	HS
15-1232	Computer User Support Specialists	513	65%	789	44%	\$24.10	Some Coll
13-2061	Financial Examiners	431	17%	2,536	343%	\$31.38	Bachelor's
13-1198	Project Management Specialists and Business Operat...	347	23%	1,508	58%	\$35.32	Bachelor's
11-1021	General and Operations Managers	310	16%	1,936	30%	\$57.05	Bachelor's
41-2031	Retail Salespersons	285	92%	309	43%	\$12.88	None
43-4141	New Accounts Clerks	260	99%	263	-52%	\$21.93	HS
43-3099	Financial Clerks, All Other	254	97%	262	-18%	\$25.37	HS
11-3031	Financial Managers	241	7%	3,492	22%	\$76.16	Bachelor's
13-1111	Management Analysts	221	13%	1,701	84%	\$47.33	Bachelor's
43-9021	Data Entry Keyers	202	99%	204	-11%	\$15.31	HS

For occupations employing more than 200 workers.

# Life Sciences & Healthcare: Jobs Most at Risk

SOC	Description	Jobs at Risk	Automation Risk %	2019 Jobs	% Chg, '14-'19	Median Hourly Earnings	Ed Level
43-4171	Receptionists and Information Clerks	4,014	96%	4,181	68%	\$15.12	HS
31-1131	Nursing Assistants	3,787	39%	9,709	5%	\$14.49	Certificate
31-1128	Home Health and Personal Care Aides	2,954	39%	7,574	7%	\$11.03	HS
43-9061	Office Clerks, General	1,867	96%	1,944	2%	\$16.92	HS
43-6013	Medical Secretaries and Administrative Assistants	1,566	81%	1,933	-3%	\$17.67	HS
31-9092	Medical Assistants	1,379	30%	4,598	58%	\$17.03	Certificate
29-1292	Dental Hygienists	1,251	68%	1,840	32%	\$36.78	Associate
43-3021	Billing and Posting Clerks	1,243	96%	1,294	13%	\$18.31	HS
43-4111	Interviewers, Except Eligibility and Loan	1,182	94%	1,257	33%	\$16.86	HS
31-9091	Dental Assistants	1,089	51%	2,135	14%	\$22.35	Certificate
37-2012	Maids and Housekeeping Cleaners	1,040	69%	1,507	8%	\$11.84	None
29-2018	Clinical Laboratory Technologists and Technicians	979	69%	1,429	12%	\$25.98	Bachelor's
43-6014	Secretaries and Administrative Assistants, Except ...	746	96%	777	-14%	\$19.08	HS
31-9097	Phlebotomists	694	63%	1,102	4%	\$16.94	Certificate
35-3041	Food Servers, Nonrestaurant	650	86%	755	-4%	\$11.78	None
35-2012	Cooks, Institution and Cafeteria	635	83%	766	64%	\$12.45	None
43-4051	Customer Service Representatives	631	55%	1,148	49%	\$18.18	HS
29-2098	Medical Dosimetrists, Medical Records Specialists,...	569	40%	1,422	-11%	\$18.28	Certificate
43-3031	Bookkeeping, Accounting, and Auditing Clerks	539	98%	550	2%	\$20.34	Some Coll
29-2052	Pharmacy Technicians	507	92%	551	20%	\$15.59	HS
49-9071	Maintenance and Repair Workers, General	381	64%	596	-2%	\$21.71	HS
37-2011	Janitors and Cleaners, Except Maids and Housekeepi...	379	66%	575	1%	\$11.95	None
13-1071	Human Resources Specialists	339	95%	356	46%	\$30.75	Bachelor's
31-9093	Medical Equipment Preparers	314	78%	402	-4%	\$16.52	HS
29-2034	Radiologic Technologists and Technicians	313	23%	1,362	3%	\$29.73	Associate
29-2055	Surgical Technologists	311	34%	916	52%	\$21.45	Certificate
13-2011	Accountants and Auditors	303	94%	322	13%	\$39.73	Bachelor's
29-2057	Ophthalmic Medical Technicians	300	34%	883	81%	\$19.23	Certificate
31-9099	Healthcare Support Workers, All Other	295	63%	469	-8%	\$15.93	HS
51-9081	Dental Laboratory Technicians	262	97%	271	-1%	\$20.36	HS
35-3023	Fast Food and Counter Workers	213	96%	222	-30%	\$10.29	None

*For occupations employing more than 200 workers.*

# Information Technology: Jobs Most at Risk

SOC	Description	Jobs at Risk	Automation Risk %	2019 Jobs	% Chg, '14-'19	Median Hourly Earnings	Ed Level
15-1232	Computer User Support Specialists	1,001	65%	1,540	27%	\$24.10	Some Coll
41-3091	Sales Representatives of Services, Except Advertis...	854	99%	863	60%	\$24.65	HS
43-4051	Customer Service Representatives	374	55%	680	-31%	\$18.18	HS
43-9061	Office Clerks, General	264	96%	275	-12%	\$16.92	HS
13-1161	Market Research Analysts and Marketing Specialists	254	61%	416	57%	\$32.14	Bachelor's
13-2011	Accountants and Auditors	252	94%	268	18%	\$39.73	Bachelor's
13-1071	Human Resources Specialists	209	95%	220	67%	\$30.75	Bachelor's
15-1256	Software Developers and Software Quality Assurance...	209	4%	4,973	36%	\$50.04	Bachelor's
15-1231	Computer Network Support Specialists	193	65%	296	-13%	\$34.59	Associate
13-2098	Financial and Investment Analysts, Financial Risk ...	156	99%	158	10%	\$45.71	Bachelor's
43-3031	Bookkeeping, Accounting, and Auditing Clerks	156	98%	159	-14%	\$20.34	Some Coll
43-6014	Secretaries and Administrative Assistants, Except ...	138	96%	143	-5%	\$19.08	HS
15-1212	Information Security Analysts	132	21%	630	92%	\$48.64	Bachelor's
13-1198	Project Management Specialists and Business Operat...	127	23%	552	64%	\$35.32	Bachelor's
41-4012	Sales Representatives, Wholesale and Manufacturing...	118	85%	139	24%	\$34.30	HS
41-4011	Sales Representatives, Wholesale and Manufacturing...	101	25%	403	55%	\$40.20	Bachelor's

*For occupations employing more than 100 workers.*

# Logistics & Distribution: Jobs Most at Risk

SOC	Description	Jobs at Risk	Automation Risk %	2019 Jobs	% Chg, '14-'19	Median Hourly Earnings	Ed Level
53-3032	Heavy and Tractor-Trailer Truck Drivers	8,280	79%	10,481	24%	\$22.00	Certificate
53-7062	Laborers and Freight, Stock, and Material Movers, ...	4,990	85%	5,870	95%	\$14.14	None
53-7051	Industrial Truck and Tractor Operators	2,176	93%	2,340	80%	\$17.18	None
53-2031	Flight Attendants	1,400	35%	4,001	26%	\$33.89	HS
43-5011	Cargo and Freight Agents	916	99%	925	11%	\$23.62	HS
49-3011	Aircraft Mechanics and Service Technicians	901	71%	1,269	27%	\$38.76	Certificate
43-9061	Office Clerks, General	725	96%	755	59%	\$16.92	HS
53-7065	Stockers and Order Fillers	663	38%	1,744	298%	\$13.55	HS
41-3091	Sales Representatives of Services, Except Advertis...	603	99%	609	72%	\$24.65	HS
43-4181	Reservation and Transportation Ticket Agents and T...	595	61%	975	3%	\$25.86	HS
49-3031	Bus and Truck Mechanics and Diesel Engine Speciali...	569	73%	779	47%	\$24.43	HS
43-4051	Customer Service Representatives	562	55%	1,022	46%	\$18.18	HS
43-5071	Shipping, Receiving, and Inventory Clerks	537	98%	548	31%	\$16.95	HS
43-5032	Dispatchers, Except Police, Fire, and Ambulance	527	96%	549	22%	\$19.68	HS
53-3033	Light Truck Drivers	513	69%	744	26%	\$15.87	HS
53-2011	Airline Pilots, Copilots, and Flight Engineers	396	18%	2,199	31%	\$54.00	Bachelor's
43-3031	Bookkeeping, Accounting, and Auditing Clerks	368	98%	376	47%	\$20.34	Some Coll
53-7064	Packers and Packagers, Hand	325	38%	855	54%	\$12.14	None
43-6014	Secretaries and Administrative Assistants, Except ...	319	96%	332	48%	\$19.08	HS
53-6098	Aircraft Service Attendants and Transportation Wor...	253	75%	337	-7%	\$13.19	HS
49-9071	Maintenance and Repair Workers, General	201	64%	314	49%	\$21.71	HS
13-2011	Accountants and Auditors	172	94%	183	37%	\$39.73	Bachelor's
13-1071	Human Resources Specialists	153	95%	161	88%	\$30.75	Bachelor's
11-3071	Transportation, Storage, and Distribution Managers	139	59%	235	9%	\$50.60	HS
53-3031	Driver/Sales Workers	136	98%	138	49%	\$8.70	HS
43-5061	Production, Planning, and Expediting Clerks	132	88%	150	42%	\$23.23	HS
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighe...	123	98%	126	70%	\$18.74	HS
41-4012	Sales Representatives, Wholesale and Manufacturing...	107	85%	126	42%	\$34.30	HS

*For occupations employing more than 100 workers.*

# Automatable, but at what cost and impact?

At first glance, identifying Hospitality as high-risk occupations may seem a bit odd; these are highly manually jobs and low-paying. So, while a machine may be able to replace a cook at a fast-food restaurant, the cost of these technologies may prove either too high to justify or too slow in their adoption. Even the Personal Services industry is shown as being highly automatable, but includes occupations such as hairdressers, personal care aides, and childcare workers. While cashiers may be replaced by kiosks, some sales representatives (such as those at retail stores) may still be viewed as part of the business model even if they can be replaced by self-checkout. To summarize, some “physical predictable” tasks may be automatable at a reasonable cost in these retail and restaurant industries, but they are likely much less prone to automation than manufacturing and warehouse jobs, where high-volume, concentrated, high-revenue work can be replaced by expensive robots.

In reality, automation is much more than replacing working to save costs. Automation will transform the nature of work and ultimately transform companies. Automation will affect workforce mix, speed to market, quality of service, and the enhancement of existing services.

Analysis by EY on the Oxford data concluded that five areas of impact will be most prevalent:

1. Fewer workers
2. Scaled capabilities
3. Greater speed
4. Higher quality
5. New capabilities (not possibly by humans)

*Automation's Five Areas of Impact*



*Business impact*

Source: [EY](#)

# Special Focus: AI in Manufacturing

An EY and Microsoft study of 86 manufacturing companies across various sectors throughout Europe revealed that 81% of respondents agree that AI has become more important for their business over the past 12 months, but just 10% say they have a detailed plan for it with initiatives and defined responsibilities. Meanwhile, 16% of respondents say that they are still developing and implementing AI on an ad hoc basis. Just 12% of respondents have managed to scale AI company-wide. These respondents reported having been on their journeys for over five years and, on average, reported lower costs, sharper decision-making and greater customer engagement.

In factories, smart sensors, the Internet of Things and AI enable predictive maintenance were reportedly used by 68% of survey respondents to save costs and extend the lifespan of important assets. Digital twins, which are virtual replicas of a product, process or manufacturing equipment to use in simulations, had also been adopted by 62% of respondents. Digital twins have been shown as a way to make supply chains more resilient. AI can also play a role at the other side of the value chain as well by enabling chatbots – used by 66% of survey respondents – to respond to inquiries quickly through text analysis, and cybersecurity intrusion identification.

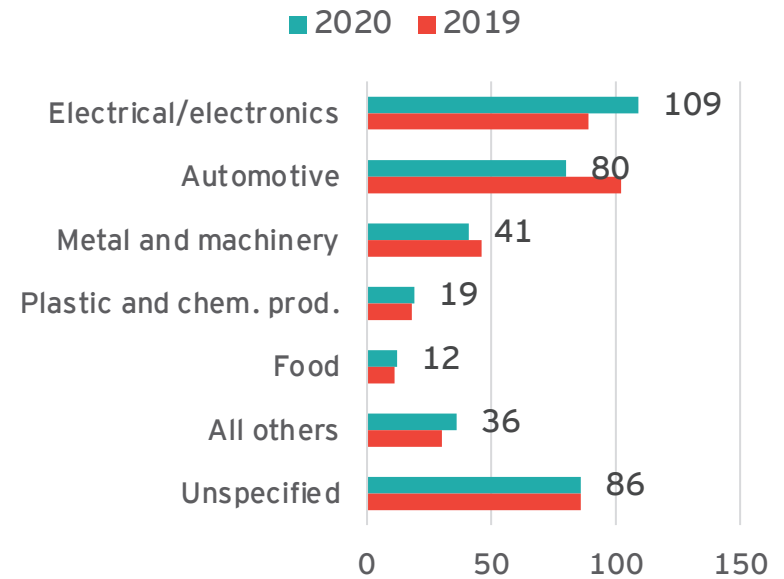
Other use cases are more nascent but also powerful – for instance, AI can help forecast customer demand (37%) and manage inventory (32%) for seamless fulfillment. Analytics also can drive better decision-making and more effective utilization of labor, and AI visual analytics can be used in maintenance for faster inspections and verifications.

# Special Focus: Manufacturing

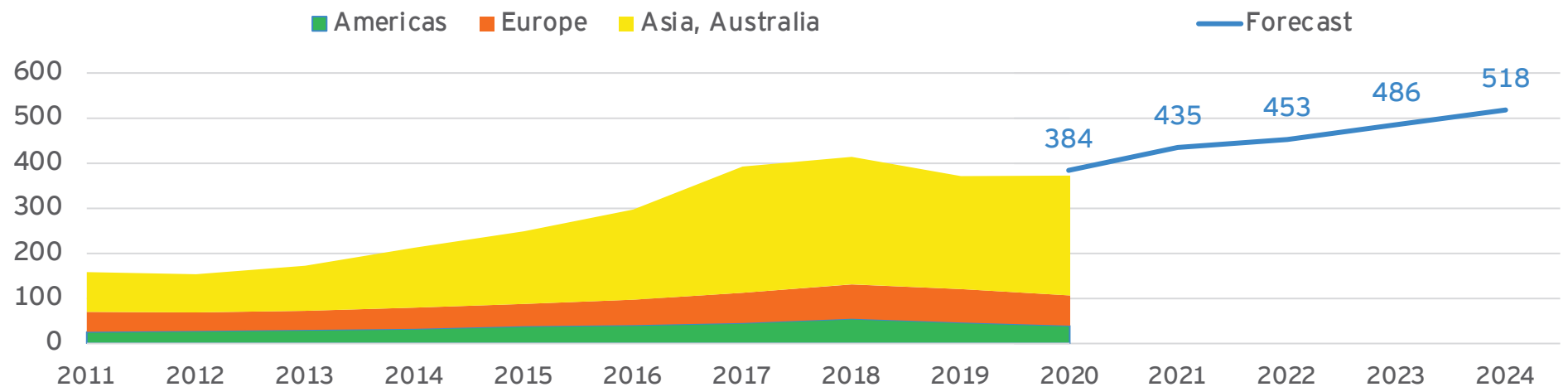
Automation in the Manufacturing industries has been driven by the installation of industrial robots to boost production and make workers more products. Long-term trends show a significant increase in robotics, from just over 150,000 unit installations worldwide in 2010 to 415,000 in 2018. A slight dip in investment in 2019 and 2020 is expected to reverse, with a nearly 40% increase in robotics installations over the next 4 years.

Electronics companies are the largest users of robots, followed by automotive. Note too that the vast majority of robotics are being installed in Asia.

Industrial Robot Installations (000s units) by Industry



Industrial Robot Installations (000s units)



Sources: *IFR*



# Special Focus: Manufacturing

EY's survey of manufacturers identified the top four use cases for AI: Transform products, Engage customers, Optimize operations, and Enable employees/support.

## The top four uses of AI adoption

	Top four use cases (%, share of respondents adopted use case)	Value potential (1-no, 5-high)	Other potential use cases
<b>Transform products</b>	▶ Digital twin (62%)	4.5	<ul style="list-style-type: none"> <li>▶ Generative design</li> <li>▶ Product variant generation</li> </ul>
	▶ R&D lab acceleration (44%)	4.2	
	▶ Product intelligence (43%)	4.3	
	▶ Market insights and social monitoring (43%)	4.0	
<b>Engage customers</b>	▶ Chatbots (66%)	3.3	<ul style="list-style-type: none"> <li>▶ Lead qualification</li> <li>▶ Content automation</li> <li>▶ Prescriptive pricing</li> <li>▶ Churn prediction and prevention</li> </ul>
	▶ Demand planning and forecasting (37%)	3.8	
	▶ Automated marketing (31%)	3.5	
	▶ Profitable field service (29%)	4.1	
<b>Optimize operations</b>	▶ Predictive maintenance (68%)	4.0	<ul style="list-style-type: none"> <li>▶ Predictive sourcing</li> <li>▶ Automated route optimization</li> <li>▶ Continuous product quality improvement</li> <li>▶ Supplier risk assessment</li> </ul>
	▶ Supply chain transparency and predictability (34%)	4.1	
	▶ Predictive inventory management (32%)	3.9	
	▶ Sustainable operations (30%)	4.1	
<b>Enable employees/ support</b>	▶ Cybersecurity intrusion identification (69%)	4.1	<ul style="list-style-type: none"> <li>▶ Interconnected recruiting</li> <li>▶ Customer credit risk identification</li> <li>▶ Virtual factory workforce support</li> <li>▶ Predictive performance management</li> </ul>
	▶ Autonomous manual and paper-based processes (66%)	4.1	
	▶ Fraud detection (31%)	3.9	
	▶ Tailored management analytics (26%)	4.1	



# Implications for Workforce Development

For most organizations, scarcity of automation talent will be the reality. Recruiting and retaining tech talent is challenging due to the competitive hiring environment and rapidly increasing salaries for professionals with automation expertise (e.g., machine learning, natural language generation, chatbots). Many forward-looking talent leaders have sidestepped the mature talent market and recruited raw talent to develop or hire from nontraditional backgrounds. Even so, automation talent is being hoarded and most organizations should expect to work with a scarcity of it – an eventuality that can be overcome with effective talent management and cultural programs.

Other companies have looked to upskill their existing workforce. In general, leaders should consider that upskilling technical talent is an option for incremental, not categorically new, skills. For example, statisticians may become data scientists, but data entry personnel will typically fail to transition to those roles. With the right underlying talent and skills analysis, a data-backed estimate of the expected talent lift through upskilling programs is possible.

Acquiring talent and technology is a commonly-pursued option as concerns over disruption and rapid technological change consistently surface. Acquisitions can provide proprietary technology and a step-change in talent capabilities, but this is not without risk. EY's Digital Deal Economy Study highlights that just 24% of companies are highly confident about their ability to retain talent and bring them into the fold of the new company culture following an acquisition. Despite the risks, the increasing pace of technology innovation and pressure to accelerate R&D have led to an increasing utilization of corporate venture capital. Partially enabling the rise of venture investment are a new breed of tools that enable organizations to scan their ecosystems for emerging disruptive technologies and startups in near real time.

# Implications for Workforce Development

Technology-driven disruption of the workplace is nothing new. Innovations throughout history, from the plough to the steam engine to the desktop computer, have displaced existing workers and organizations by creating new business models, revenue streams and talent needs. In the same way, automation has the potential to radically reshape organizations and the people within them.

Leaders today have the opportunity to stay ahead of competitors by adopting a rigorous approach for identifying and prioritizing automation projects that build distinctive market advantages and deliver value for their organizations, customers and society at large. One-off projects are achievable with sufficient energy and dedication. However, to do so sustainably and at scale requires linking the organization's automation and people strategies.

The result is that automation transformations are a team sport, requiring functional, innovation, IT and people leaders to align selected projects, underlying analyses and the decision to build, buy or partner. By taking a cross-functional and analysis-led implementation approach, leaders can best position their organizations for a future workplace fueled by automation.

# Ways to Prepare Workers for AI-powered Skills

Economic and workforce developers will face significant new challenges in preparing and training workers to use AI-enabled technologies. Existing workforce will need new training, and displaced workers will need re-training.

Future workers will need to be drawn from a large diverse set of skills, not just software coders and mathematicians. AI pilot projects require IT, marketing, product, and other leaders across a corporation. AI is an enabling technology that must be understood by everyone but has differing entry points and contributions.

Furthermore, education at the K-12 level may need to evolve to introduce students to AI problems and techniques in an accessible manner, such as through games (such as the Junior Achievement business operations game). Potential future workers may come from teen gamers as more of the economy moves into the metaverse or jobs use technologies such as Augmented Reality.

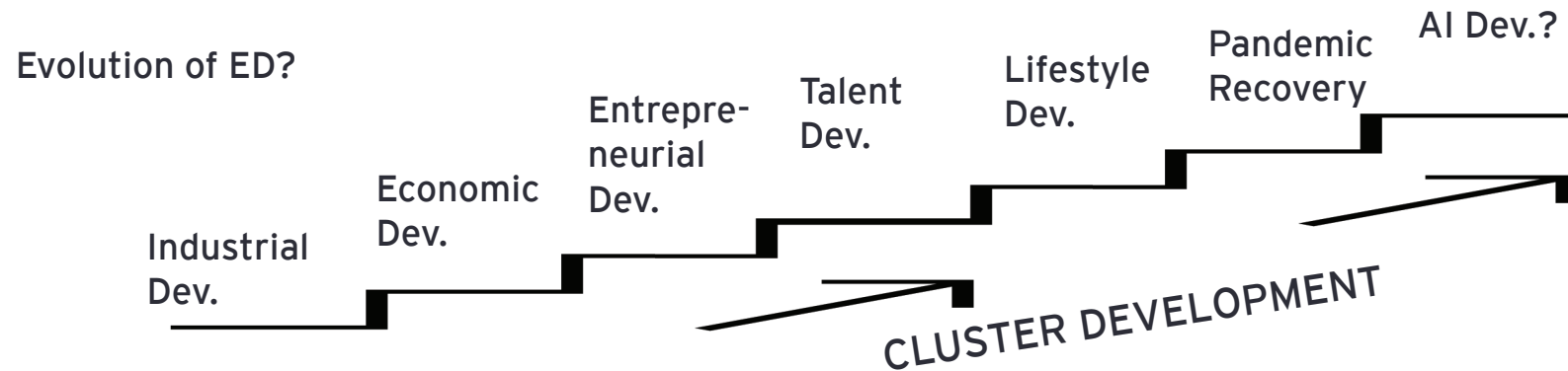
Finally, suppliers may need training on AI technologies and skills, both as a business model and workforce development model. Now, powerful new forces are driving the Internet of Things down to lower-level of suppliers to help boost the supply chain resiliency as well as deliver carbon footprint data to OEMs and end-customers.

**“Developing professional certification, compliance monitoring, and oversight programs for AI – and the auditing expertise their execution will require – will be a crucial societal project .”**

**- Eric Schmidt and Henry Kissinger (Age of AI)**

# Possible Evolution for Economic Development Practitioners

Could AI be the next evolution for our economic development profession? For the past 25 years, economic developers have witnessed the expansion of their job description from focusing exclusively on industrial development (whale hunting) to developing talent (the #1 site selection concern pre-pandemic). Is the adoption of AI a now critical next step for local economies, to work together to ensure that companies are on the winning side of this AI battle?



If so, which EDO(s) will be the first to have a “VP of AI”? Could the responsibilities range from university commercialization to supplier services to talent development? AI adoption is here and growing, but the identification of winners and losers will take time. Proving use cases and training AI systems will also take time. The expansion of AI software systems into highly educated roles will also have to be monitored. While many occupations will be vastly enhanced by AI (e.g. scientists and engineers), many other highly paid professions will be at risk (e.g. accountants and financial advisors) if they don’t adopt AI technologies.

**“We should reframe the discussion of automation from displacement to empowerment of workers.”**

**- Chris Engle, Assoc. National Director, Economic Development, EY**

# AI/Workforce Automation Risk Assessment: Appendix



# Centralina target industry definitions

INDUSTRY	NAICS	NAICS Description
Advanced Manufacturing	311	Food Manufacturing
	3121	Beverage Manufacturing
	325	Chemical Manufacturing
	326	Plastics and Rubber Products Manufacturing
	327	Nonmetallic Mineral Product Manufacturing
	331	Primary Metal Manufacturing
	332	Fabricated Metal Product Manufacturing
	333	Machinery Manufacturing
	334	Computer and Electronic Product Manufacturing
	335	Electrical Equipment, Appliance, and Component Manufacturing
	3362	Motor Vehicle Body and Trailer Manufacturing
	3363	Motor Vehicle Parts Manufacturing
	3364	Aerospace Product and Parts Manufacturing
	337	Furniture and Related Product Manufacturing
339	Misc. Manufacturing	
Financial Services	521	Monetary Authorities-Central Bank
	522	Credit Intermediation and Related Activities
	523	Securities, Commodity Contracts, and Other Financial Investments and Related Activities
	524	Insurance Carriers and Related Activities
	525	Funds, Trusts, and Other Financial Vehicles
	5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services
5611	Office Administrative Services	

# Centralina target industry definitions, continued

INDUSTRY	NAICS	NAICS Description
Life Sciences & Healthcare	3391	Medical Equipment and Supplies Manufacturing
	621	Ambulatory Health Care Services
	622	Hospitals
	623	Nursing and Residential Care Facilities
	90262	Hospitals (State Government)
	90362	Hospitals (Local Government)
Information Technology	5112	Software Publishers
	5182	Data Processing, Hosting, and Related Services
	5191	Other Information Services
	5415	Computer Systems Design and Related Services
Logistics & Distribution	4811	Scheduled Air Transportation
	4812	Nonscheduled Air Transportation
	4841	General Freight Trucking
	4842	Specialized Freight Trucking
	4881	Support Activities for Air Transportation
	4884	Support Activities for Road Transportation
	4885	Freight Transportation Arrangement
	4889	Other Support Activities for Transportation
	4931	Warehousing and Storage
	541614	Process, Physical Distribution, and Logistics Consulting Services