Preparing Technicians for the FUTURE OF WORK

National Career Pathways Network 2020

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Project Team

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Preparing Technicians for the FUTURE OF WORK

- Nature of work changing at unprecedented speeds
- Technology advancements in machine learning, AI, IoT, and robotics eliminating some jobs, creating others
- Technicians sit at the center of much of this disruption
- Education must keep up
- Our students' career paths will evolve

This NSF Advanced Technological Education Project's Role

Enable the NSF-ATE community (2-year colleges) to collaborate regionally with industry partners, within and across disciplines, on the transformation of associate degree programs to prepare US technicians for the work of the Future.

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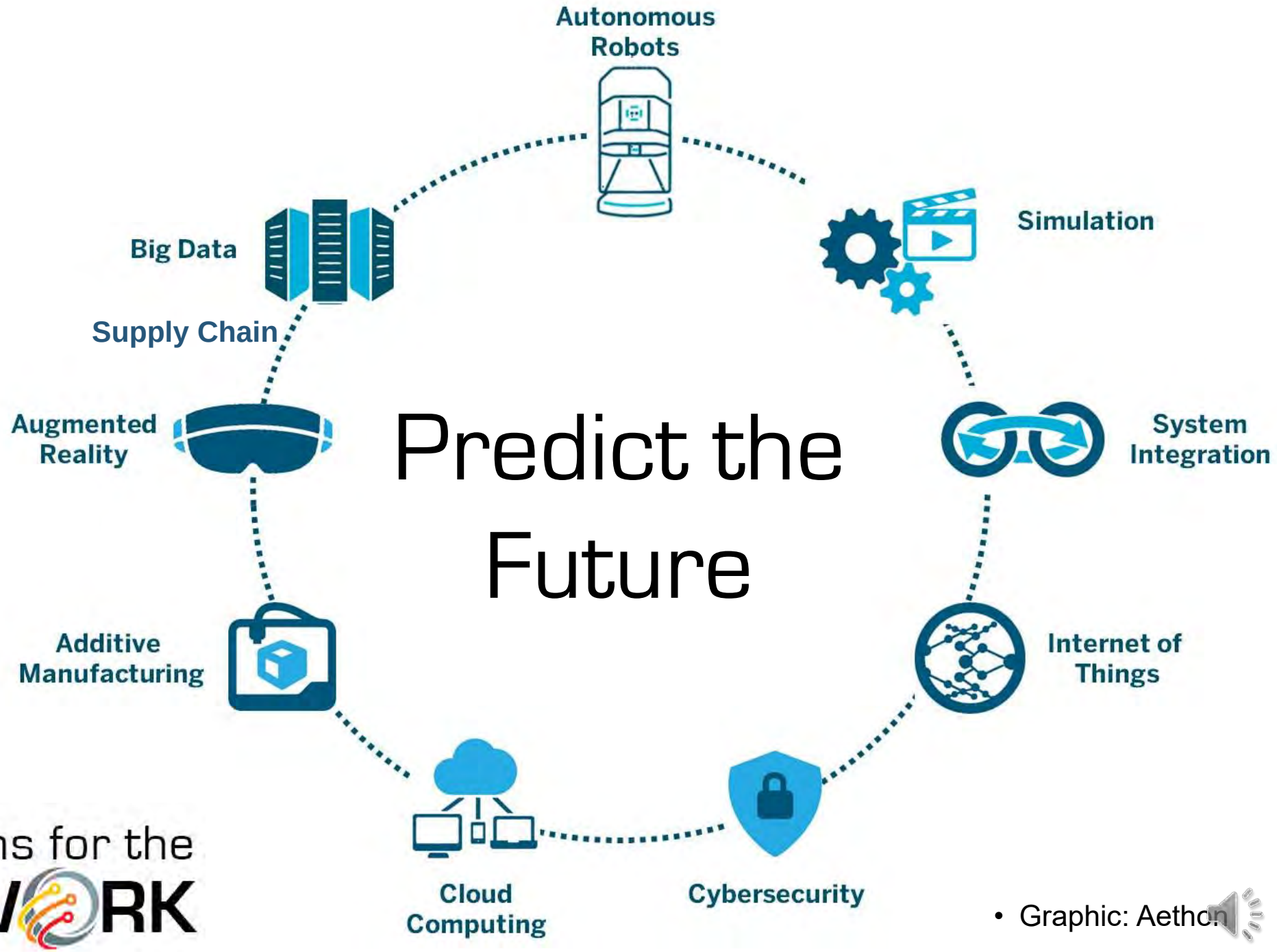
Overarching Project Outcomes

1. Identify industry's perception of the Future of Work and implications for technician education
2. Identify new technologies and cross-cutting technologies impacting technician education
3. Provide colleges with new levels of knowledge about the future technician's role.
4. Develop recommendations to address major education and workforce challenges.
5. Provide the NSF with project-informed knowledge of cross-discipline and emerging discipline issues relative to the Future of Work.

Our Job?



Preparing Technicians for the
FUTURE OF WORK

- Graphic: Aethon

Just a Few Industry 4.0 Technologies

- The Internet of Things
- Automation
- Augmented Reality/Simulation
- Simulation
- Supply Chain/Customization
- System Integration
- Cybersecurity
- Big Data
- Additive Manufacturing
- Cloud Computing

The STEM Technician's Role

Smart machines are getting smarter and production, assembly, monitoring, and maintenance in a wide variety of industrial settings are becoming more efficient.

What does this mean for role of the technician?

Two things to keep in mind...

1. Technology eliminates job categories, not work
2. Technology is transformational

Job Categories – Globally Declining – 75 Million jobs by 2022

World Economic Forum, Future of Jobs, 2018

- Data Entry Clerks
- Accounting, Bookkeeping, Payroll Clerks
- Administrative and Executive Assistants
- Assembly and Factory Workers
- Customer Service Workers
- Business Service Managers
- Accountants and Auditors
- Recording and Stock Clerks
- Postal Service Clerks

Job Categories – Globally Emerging – 133 Million by 2022

World Economic Forum, Future of Jobs, 2018

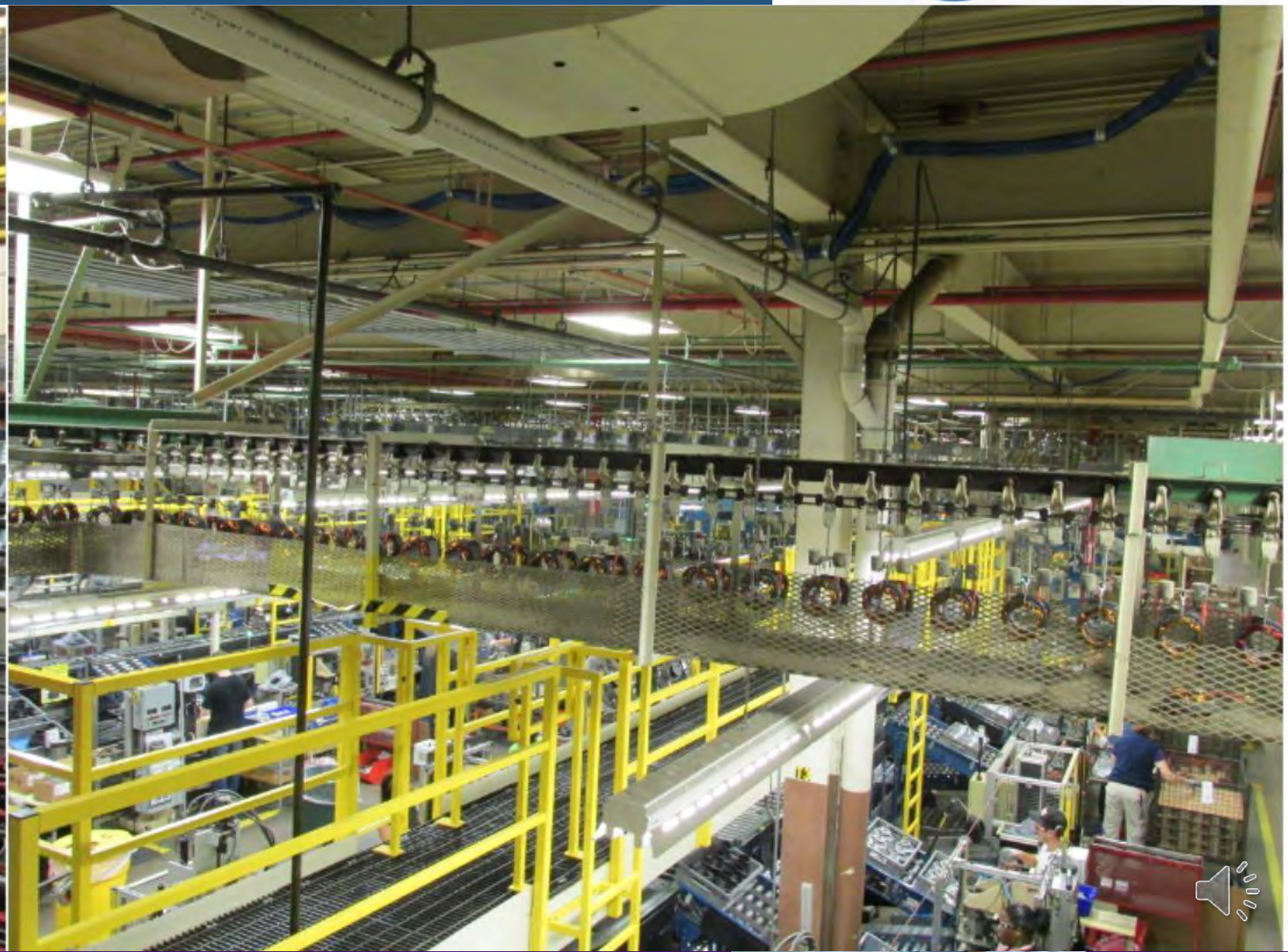
- Data Analysts
- Machine Learning Specialists
- Software Developers
- Sales and Marketing Professionals
- Big Data Specialists
- Digital Transformation Specialists
- New Technology Specialists
- Organizational Dev. Specialists
- Information Technology Services

Project Activities

- Industry site visits and interviews
- Regional convenings of employers and educators
- Regional networks
- Professional development
- Technical program modification recommendations
- Podcasts, blogs, and other content resources

Bluegrass Community & Technical College and TMMK (Toyota), Lexington, KY

Emerson InSinkErator, Racine, WI



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Future of Work Observations from the Site Visits

1. More robots and more cobots with more functionality, which means they're more complicated and more connected, are being installed everywhere.

2. Most technicians need to know more about digital communication protocols between equipment.

3. More connected and automated robots and machines mean more challenging troubleshooting situations.

Future of Work Observations from the Site Visits

4. Across all the operators and technicians, strong fundamentals in math, science and technology are key to understanding the new equipment and processes

5. Employability skills (or the “soft” skills) are still extremely important—maybe even more so today than they have been in the past.

6. Business knowledge is minimally expected of technicians and advanced operators

Future of Work Observations from the Site Visits

7. Cyber security (with exception of general behavior awareness, phones, etc) is not a concern for technicians and advanced operators.

8. Industry 4.0 is not a full bloomed reality but is being implemented almost one sensor at a time.

Interview Highlights: Technician

“Nothing has changed except the tool set and speed of response to technology changes.”

Interview Highlights: Technician Supervisor

"On the technician side, there's less call for PLCs but the ones that are needed are much more complex, with a lot of integration and function block programming. Technicians need to be able to follow multi-machine integration. There are fewer problems with the new PLCs but the problems are more significant when something happens."

Interview Highlights: Technician Supervisor

"One of our core operating principles is making minor and major decisions based on factual information. We already push a great deal more data down to the floor level to make it both visible and actionable by floor level employees. We anticipate the reliance on data for worker actions to continue to increase in the future."

Interview Highlights: Middle Management

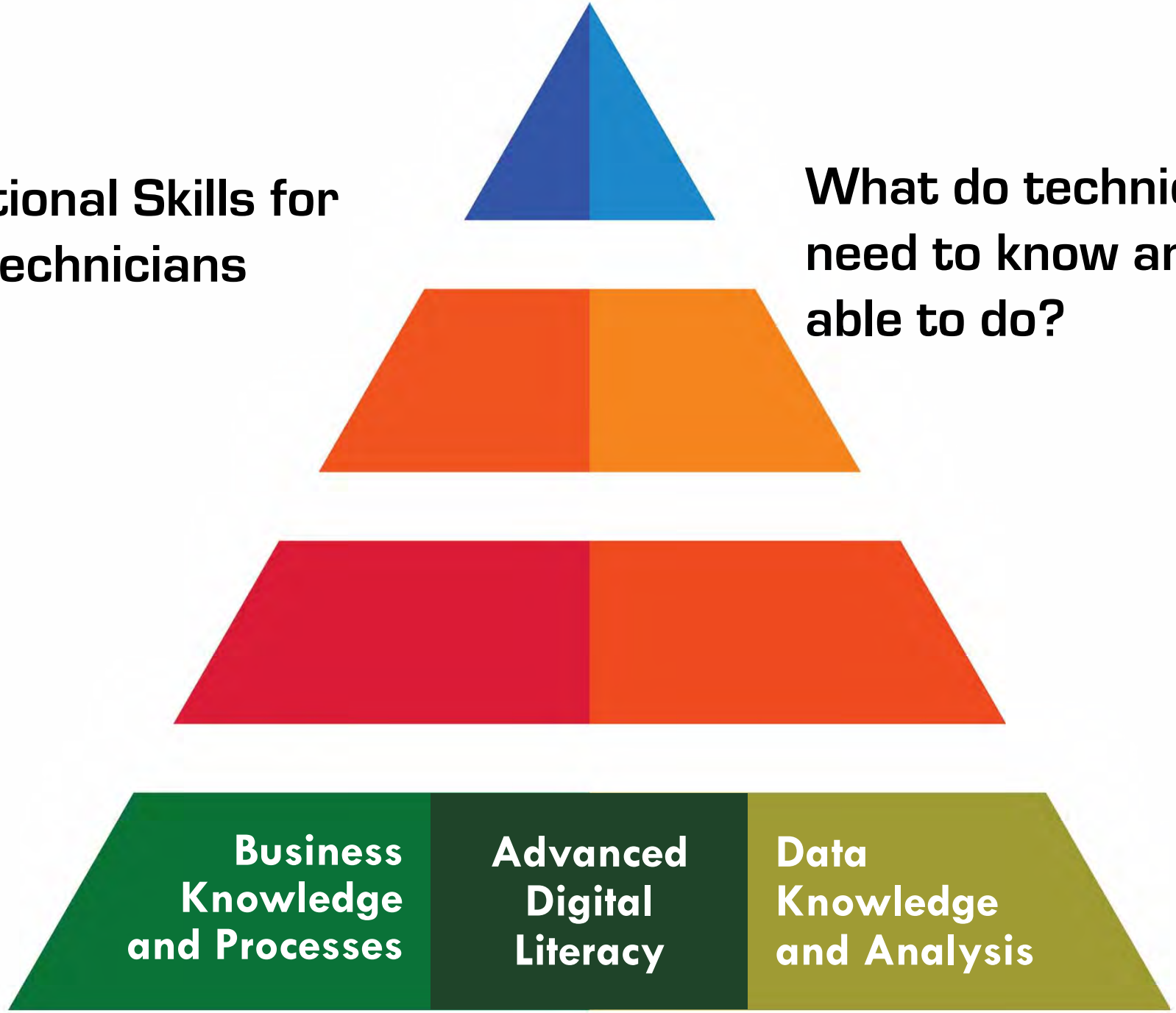
"We're constantly installing new equipment. With new lines, comes new technology – new robotics, different/more/better communication systems. New technology is a constant."

Are there specific knowledge and skill areas that will help “future proof” STEM Technicians?

- **Skill Area 1: Data Knowledge and Analysis**
- **Skill Area 2: Advanced Digital Literacy**
- **Skill Area 3:Business Knowledge and Processes**

Foundational Skills for STEM Technicians

What do technicians need to know and be able to do?



Skill Area 1: Data Knowledge and Analysis

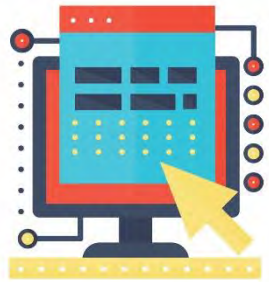
Manipulate, interpret, compare, contrast, merge, and “operate” on data to resolve issues/problems and use Excel and other common software proficiently to accomplish tasks

Essential Cross-Cutting Skills in Data Knowledge and Analysis

1. Computational thinking *
2. Data analysis *
   - Statistics
   - Analytics tools *
   - Data visualization *
3. The data management life cycle
4. Data literacy/fluency *
5. Data management
   - Data storage
   - Spreadsheets *
   - Data modeling
   - Databases
   - Query languages
   - Data backup and restoration

Skill Area 2: Advanced Digital Literacy

Understand digital communications and networking; cloud interface; cybersecurity; machine learning, sensors, programming and human-machine interfaces at a higher than introductory level



Essential Cross-Cutting Skills in Advanced Digital Literacy

1. Artificial Intelligence
   - Machine learning
2. Automation/robots *
   - Human-Machine Interface *
3. Basic programming
4. Function block diagram programming
5. Digital literacy/fluency *
   - Cloud literacy
6. Digital twins
7. Edge computing
8. Network architecture
9. Network/device communication *
   - Internet of Things (IoT)
   - Security controls *

Skill Area 3: Business Knowledge and Processes

Understand an enterprise, its value chain, and business practices. Includes work performance skills as well as ethics surrounding use of new technologies.

Essential Cross-Cutting Skills in Business Knowledge and Processes

1. Blockchain
2. Overall Equipment Efficiency
3. Business cycles
4. Communication *
5. Continuous process improvement *
6. Entrepreneurship
7. Ethics *
8. Customer focus/Stakeholder analysis *
9. Lean processes *
10. Market trends
11. ROI, or return on investment
12. Risk management
13. Supply/demand
14. Logistical chains
15. Vertical and horizontal integration

Why are these skills critical?

A core benefit of foundational skills is the capacity to adapt: having a broader skill base isn't simply about meeting the needs of today's jobs. Rather, these skills equip jobseekers and incumbent employees for the future, enabling them to navigate a dynamic landscape of accelerating change: job losses, job changes, and job creation.

"Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation" (New York: McKinsey Global Institute, 2017)

Pilot Regional Convening, Winston-Salem, NC

Who participated?

- NSF ATE Principal Investigators
- Regional industry representatives
- Faculty in STEM technical programs
- College Continuing Education administrators
- Workforce & Economic Development Agency staff
- Subject matter experts
- Apprenticeship coordinators

Convening Content and Processes

- Presentations by experts on:
  - Regional implications of the future of work
  - Data Knowledge and Analysis, Advanced Digital Literacy, and Business Knowledge and Processes
- Discussions centered around determining strategies to meet regional needs
- Regional Network development to support technician workforce development

Project Resources on Our Website preparingtechnicians.org

- Podcasts, such as:
  - A Robot for Every Technician? A Look at Trends Driving Manufacturing
  - Agility and Resilience in the Modern Workforce
  - Micro-credentials in Training and Education
- Blog posts, such as:
  - STEM Technician Students Surveyed About Remote Instruction
  - COVID-19, Higher-Ed, and What the Future Holds
  - The ABCs of I4.0: What Technicians Need to Know about Incoming Technologies

Project Resources on Our Website preparingtechnicians.org

- Instructional resources
  - Lessons covering each of the subtopics within the “big three”
  - Introduces topics all STEM technicians will need to be familiar with
  - Easy to integrate into one class period
  - Click on the Resources tab on our website to access
  - We would love to receive feedback on them!
- To subscribe to our monthly email newsletter and follow us on social media, click on the Contact Us tab on the website.

Add Your Voice

What changes in career and technical education do you think will be prompted by Future of Work-driven issues?

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