



Preparing Technicians for the **FUTURE OF WORK**



Implementing the Cross-Disciplinary STEM Core

HI-TEC Workshop: July 26, 2022



Project Team

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WORKSHOP PARTICIPANTS

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Texas

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Wisconsin

Workshop Objectives

1. Foster understanding of cross-disciplinary skill sets future technicians will need
2. Explore resources and strategies for introducing students to Cross-disciplinary STEM Core
3. Draft action plan for implementing Cross-Disciplinary STEM Core



Workshop Webpage

preparingtechnicians.org/hitec-workshop/



Agenda

- Project Background
- The Cross-Disciplinary STEM Core
- Options for Adoption
- Leveraging Scenario-Based Instruction
- Embedding STEM Core Skills through Instructional Cards
- Drafting an Action Plan for Implementation:
Your Classroom and Beyond



Project Background

- Technology advancements in machine learning, AI, IoT, and robotics eliminating some jobs, creating others
- Nature of work changing at unprecedented speeds
- Technicians sit at the center of much of this “disruption”
- NSF ATE funding

Preparing Technicians for the
FUTURE OF WORK

preparingtechnicians.org



Project Mission

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

Project Goals

1. Empower community colleges to prepare technicians for work of the future.

2. Promote regional collaboration between community colleges and industry to determine the technical demands of work of the future.

3. Support ATE Regional Networks focused on technician education for work of the future.

4. Foster adoption of Cross-disciplinary STEM Core to maximize impact on technician education





Driving Questions

- What new advanced technologies are rapidly being adopted?
- How is new technology changing what technicians need to know and be able to do?
- What new knowledge and skills are needed?
Are there any that *all* STEM technicians need?
- How will colleges teach new knowledge and skills in existing technical associate degree programs?



Globally increasing demand for these job categories

- Data Analysts
- AI/Machine Learning Specialists
- Big Data Specialists
- Digital Marketing Specialists
- Process Automation Specialists
- Digital Transformation Specialists
- Information Security Analysts
- Software and App Developers
- Internet of Things Specialists
- Project Managers

What does this mean for technicians?

As jobs come to be redefined by new modes of work, the result is a *hybridization* that mashes together skills from disparate domains and demands greater breadth and flexibility of the workforce.



Identifying What Future Technicians Need To Know

- Industry site visits/interviews
- Focus groups with ATE educators and industry advisors
- Regional convenings of educators and industry
- HI-TEC Special Interest Groups
- Subject Matter Experts
- Review of current research

Iterative Process

Results: Prioritized lists of knowledge and skills within three broad content areas



“Future proofing” STEM Technicians

Cross-Disciplinary STEM Core:

Skill Area 1: Data Knowledge and Analysis

Skill Area 2: Advanced Digital Literacy

Skill Area 3: Business Knowledge and Processes

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks

Essential Skill Sets

- Computational thinking
- Data analysis
- Statistics
- Analytics tools
- Data visualization
- Data fluency
- The data life cycle
- Data management:
 - Data storage
 - Spreadsheets
 - Data modeling
 - Databases
 - Query languages
 - Data backup and restoration

Analytics tools
Computational thinking
Data analysis
Data backup and restoration
Databases
Data fluency
Data life cycle
Data management
Data modeling
Data storage
Data visualization
Query languages
Spreadsheets
Statistics

Essential Skill Sets

- Artificial Intelligence/machine learning
- Automation/robotics
- Basic programming
- Cloud literacy
- Digital literacy/fluency
- Digital twins
- Human-Machine Interface
- Function block diagram programming
- Edge computing
- Internet of Things (IoT)
- Network architecture
- Network/device communication
- Security controls

Understanding digital communications and networking, cybersecurity, machine learning, sensors, programming, and robotics at a higher than introductory level

Artificial intelligence/
machine learning

Automation/robotics

Basic programming

Cloud literacy

Digital fluency

Digital twins

Edge computing

Function block diagram
programming

Human-Machine Interface (HMI)

Internet of Things (IoT)

Network architecture

Network communication

Security controls

Essential Skill Sets

- Continuous process improvement
- Customer/stakeholder analysis
- Entrepreneurship
- Ethics
- Lean processes
- Market trends
- Overall Equipment Efficiency (OEE)
- Return on Investment (ROI)
- Risk management
- Supply Chains
- Supply and demand
- Vertical and horizontal integration

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies

Business cycles
Blockchain
Communication
Continuous process improvement
Customer/stakeholder analysis
Entrepreneurship
Ethics
Lean processes
Supply chains
Market trends
Overall Equipment Efficiency (OEE)
Return on Investment (ROI)
Risk management
Supply and demand
Vertical and horizontal integration

Why Are Cross-Disciplinary STEM Skills Critical?

“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.”

What Skills Are Companies Looking For?

PODCAST EXCERPTS

Episode 16, Cross-Cutting Skills in Advanced Manufacturing for Medical Devices
Matthew Carter, Vice President, Cook Medical, Winston-Salem, NC



Episode 33, Technicians Enabling the Cloud



Aaron Osmond, US Lead – Education to Workforce Team, Amazon Web Services



Are you teaching skills
from the cross-disciplinary
STEM core?

Where/how do they fit
within your courses?


Discussion




Framework for a Cross-Disciplinary STEM Core

Preparing Technicians
for the Future of Work

**A Framework for a
Cross-Disciplinary STEM Core**



Preparing Technicians for the
FUTURE OF WORK



CORD
*Leading Change
in Education*

DATA KNOWLEDGE AND ANALYSIS

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks

- Analytics tools
- Computational thinking
- Data analysis
- Data backup and restoration
- Databases
- Data fluency
- Data life cycle
- Data management
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- Query languages
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- Statistics

ADVANCED DIGITAL LITERACY

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BUSINESS KNOWLEDGE AND PROCESSES

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies

- Business cycles
- Blockchain
- Communication
- Continuous process improvement
- Customer/stakeholder analysis
- Entrepreneurship
- Ethics
- Lean processes
- Logistical chains
- Market trends
- Overall Equipment Efficiency (OEE)
- Return on Investment (ROI)
- Risk management
- Supply and demand
- Vertical and horizontal integration

About the Framework

1. Presents the national need for multi-skilled technicians in the age of Industry 4.0/X.0
2. Identifies knowledge and skills for future-proofing technicians—the Cross-Disciplinary STEM Core
3. Recommends actions colleges can take and roles stakeholders should play in adopting the Core in technical programs





**Where do we find room
for the STEM Core skills?**

Framework Recommendations

- Prioritize skill sets with employers
- Determine integration points
- Develop real-world scenarios
- Provide faculty development
- Support systemic change





CONSIDER REGIONAL NEEDS

Technical programs address local/regional industry sectors. **Which of the core skill sets are most needed in your region?**

What type of instructional resources would help your college integrate regionally prioritized core skill sets?

Roles for Everyone

- Instructional Leaders and Faculty
- Employer Partners
- College Presidents

Recommended Framework Action:

Develop Real-World Scenarios



Preparing Technicians for Work of the Future

- Scenario-based instruction helps students see how a broad, versatile skill set will be important to their futures
- Project SMEs developed **real-world scenarios** integrating multiple skill areas from cross-disciplinary STEM Core

Examples: A biotechnician applies principles of cybersecurity or an IT technician using data visualization to address a situation




Real-world Scenarios

- Contain fact-based stories provided by local companies, modified from news headlines, or invented (must be plausible)
- Provide the real-world context in which the lesson/project takes place
- Prepare students to examine a complex situation
- Illustrate the need for using an integrated, multi-disciplinary instructional approach

Why Use Scenarios?

- Provide “instant” lesson context
- Facilitate development of lessons that meet employer/workforce needs
- Prepare technicians for work of the future
- Engage students in learning
- Students learn best in environments that thrive on real projects, real problems, and complex discussions
Bransford, Brown, & Cocking, 2000






Rate the Scenario: **Good, Bad, or Indifferent?**

1. What is the real-world context?
2. What is the complex problem being addressed?
3. How are multiple skill areas required for solving the problem?
4. Can this scenario be improved?

Scenario 1

A manufacturing facility had problems with consistent equipment breakdowns causing assembly lines to stop working. The equipment was overheating, vibrating, and losing electrical connectivity. The maintenance technicians would find the problems but only after the assembly line broke down. The company was losing money on a weekly basis. The plant manager asked Cynthia, a production technician, to find a solution. After a few days Cynthia reported to her manager she found a solution using IoT. Cynthia's plan was to install IoT devices to monitor the part of the assembly line that was breaking down. The IoT devices were attached to the motors, conveyor belts and electrical systems, and then connected to a central monitoring system. The central monitoring system allowed the maintenance technician to identify and repair parts that were going bad before they failed and shut down an assembly line.




Rate Scenario 1: **Good, Bad, or Indifferent?**

1. What is the real-world context?
2. What is the complex problem being addressed?
3. How are multiple skill areas required for solving the problem?
4. Can this scenario be improved?

Scenario 2

How will a technician use data visualization? Evan Garcia is a technician for Green Mountain Power Company. He is responsible for tracking increased system outages over time across a metropolitan network, collects outage statistics, including system logs, environmental information, and helpdesk ticket details from network nodes and service centers in order to determine the cause. Evan stores the data in an Excel workbook, then imports data into SAS, Tableau, or MS Power BI visualization tools and creates a dashboard to present to management. The data dashboard provides an interactive geographical heat map showing outage details and other graphical representations of his data analysis of the event. The heat map allows management to make real-time decisions and troubleshoot problems.



Rate Scenario 2: **Good, Bad, or Indifferent?**

1. What is the real-world context?
2. What is the complex problem being addressed?
3. How are multiple skill areas required for solving the problem?
4. Can this scenario be improved?

Instructional Formats Built on Scenarios

Short-term

- Lessons and activities

Longer-term

- Project-based learning
- Case studies
- Research

The image displays three student resource cards, each with a title bar, main content, and a small image at the bottom.

- Card 1: Data Knowledge & Analysis - SPREADSHEETS**
 - Student Resource**
 - What are spreadsheets and how are they related to Data Knowledge & Analysis?**

A spreadsheet is a file created using software such as Microsoft Excel to capture, display, and manipulate data arranged in rows and columns. Technicians collect data as part of their normal daily workflow to install and configure systems, diagnose problems, and perform maintenance. Spreadsheets are a convenient way to store and analyze data. Once the data is stored, the technician can analyze the data, including summarizing and creating data visualizations.
 - Vocabulary**
 - **CSV** – the file extension separated by commas : spreadsheets
 - **Data visualization** – re diagram, or infographic understood
 - **Export** – to copy or im saved or imported into back up and save impo of a file
 - **Pivot table** – a Excel to from specific rows and trends and patterns
 - How will technicians use spreadsheets?**
 - Image:** A small image showing a spreadsheet interface.
- Card 2: Advanced Digital Literacy - BASIC PROGRAMMING: PYTHON**
 - Student Resource**
 - What is Python and how is it related to basic programming?**

Basic programming tells a computer what to do using a language (code) it understands. One easy-to-learn programming language is Python. It uses open-source code that can run on a variety of computer systems. Technicians use Python for a variety of applications, including data analysis and visualization, automation, web and mobile app development, software testing and Machine Learning.
 - Vocabulary**
 - **Debugging** – the process of finding and fixing errors in a program
 - **Object** – a group of related functions unit
 - **Object-oriented programming** – code interact with one another
 - **Python Enhancement Proposal (PEP)** – Python code
 - **Repository** – a digital archive where application are stored along with those files
 - **Software library** – a digital collection specific purposes and shared with other developers
 - **Statement** – single line of code write carried out
 - How will technicians use Python for basic programming?**
 - Image:** A small image showing a Python code editor.
- Card 3: Business Knowledge & Processes - LEAN PROCESSES**
 - Student Resource**
 - What are Lean processes and how are they related to Business Knowledge & Processes?**

Lean processes focus on maximizing customer value while using fewer resources and minimizing waste. Lean thinking means always thinking about how processes and products can be improved.
 - Vocabulary**
 - **Continuous process improvement** – the ongoing improvements of products, services, or processes; related to the Japanese term *Kaizen* – improvement; good change
 - **Efficiency** – the ability to achieve a goal with the least amount of waste
 - **Waste** – materials or processes that are not creating value for the customer
 - **Value** – what the customer is willing to pay for goods they want
 - **Value stream** – all the steps in a work process that end with something a customer wants
 - **Pull** – producing and delivering products and services when there is customer demand for them; related to the Toyota Kanban method
 - **Flow** – ensuring steps in the value stream run smoothly without interruptions, delays, or bottlenecks
 - **Perfection** – the overarching goal of meeting customer needs and striving to do it better each day ([source](#))
 - How will technicians use Lean processes?**

Amelia is a manufacturing technician for an automotive parts company. She has been recognized for her contributions to the company's delivery of quality parts on time to their customers. Recently, Amelia was becoming frustrated that her workstation was being left in disarray from the previous shift. This was impacting her daily production goals. She discussed this with her supervisor and found out there were other issues affecting productivity across shifts. Her supervisor facilitated a meeting with all the technicians to identify the root cause of the problems. Together they came up with a plan to address the decreased productivity. The last 10 minutes of a shift would overlap with the first 10 minutes of the next shift. Processes would not stop running – the flow (a critical principle of Lean manufacturing) would continue – but the technicians would have time to communicate important information, clean the work area, and check machinery (if needed). This change increased the company's manufacturing productivity and resulted in higher job satisfaction for Amelia and the other technicians.
 - Diagram:** A process flow diagram with icons for VALUE, VALUE STREAM, PULL, FLOW, and PERFECTION.
 - Image:** A small image showing a manufacturing technician working.



Project Resource: Instructional Cards

- Designed to help colleges infuse technical courses with the content of the Cross-Disciplinary STEM Core without having to add new courses to an already full program sequence
- Provides short, informative, introductory content for students and instructors and an activity that instructors can facilitate
- Includes real-world scenarios in which technicians use the knowledge and skills in a work setting



Student Content

- Designed to give students a “taste” of the skill set; provides introductory information
- Definition
- Basic, essential vocabulary
- Real-world scenario of a technician using the topic content in a work setting

SPREADSHEETS

What are spreadsheets and how are they related to Data Knowledge & Analysis?

A spreadsheet is a file created using software such as Microsoft Excel to capture, display, and manipulate data arranged in rows and columns. Technicians collect data as part of their normal daily workflow to install and configure systems, diagnose problems, and perform maintenance. Spreadsheets are a convenient and simple tool with which to store this data. Once the data is stored, the technician can use spreadsheet features to analyze data, including summaries, trends, and patterns. Spreadsheets can also be used to create data visualizations.

Vocabulary

- **CSV** – the file extension indicating that data will be displayed separated by commas and line breaks; compatible with all spreadsheets
- **Data visualization** – represents information in the form of a chart, diagram, or infographic so that data can be quickly and easily understood
- **Export** – to copy or move data from one program or computer to be saved or imported into another program; exporting can be used to back up and save important data or to move data between versions of a file
- **Pivot table** – a Excel tool used to reorganize and summarize data from specific rows and columns of data, making it easier to spot trends and patterns

- **TSV** – the file extension indicating data will be displayed separated by tabs; used when data is stored in tables
- **XLS or XLSX** – the file extension that indicates a spreadsheet can be opened in Microsoft Excel

How will technicians use spreadsheets?

Shanice is a Solar Technician on a solar farm. Recently her company installed sensors on each panel. The sensors collect data including voltage, current, temperature and the amount of sunlight reaching the panel. When there was a problem with the system in the past, Shanice would need to walk through the solar farm and examine each panel to determine which panels were malfunctioning. Now the sensors on the panels transmit readings to a database available on a computer at her workstation. When there is a system problem, Shanice logs into the database, exports the data to a CSV file, or a comma separated file, clicks on “Save As,” and selects the “xlsx file” option where it’s converted to an Excel spreadsheet. She then can review data that is displayed in with rows and columns (or use the program to create data visualizations) where she can easily spot the specific panel that is the source of the issue. Shanice can go directly to that panel and service it.



Student Content

- Broad skill set description
- Community college programs where these skills are commonly taught
- Where the skill set is forecast to expand and change in the future
- Links to appropriate level, vetted outside learning resources

SPREADSHEETS

Skills Needed for a High-Paying Career

- Creating spreadsheets
- Manipulating data cells using copy/cut/paste
- Analyzing data
- Organizing and formatting related data
- Sorting data
- Creating charts
- Importing data from an external source

Education

Your local community college provides the advanced technology classes you will need. STEM technicians often use spreadsheet programs that are unique to their field. Spreadsheet skills are most often taught within Information Technology, Computer Science, Data Science, Data Analytics, or Business programs offering associate degrees and one-year certificates. You'll also find applicable skills in technical specializations, such as agriculture, cybersecurity, biomedical, energy, engineering, and environmental technologies. Community college course schedules are designed to accommodate the needs of working students and often include online and hybrid delivery formats. [Find your nearest community college here.](#)

Future Trends

In the future, spreadsheets will be able to:

- Work seamlessly with Big Data
- Analyze and correct unreliable and missing data
- Join external datasets together
- Provide analysis tools which utilize machine learning

Learn More

- [What is a Spreadsheet?](#)
- [Microsoft Excel Video Training](#)
- [Google Sheets Tutorial](#)
- [Creating Pivot Tables in Excel](#)



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Instructor Content

- Designed for instructors who are not content experts in the skill area
- Essential competencies
- Cross-disciplinary skills
- Two more scenarios

Data Knowledge & Analysis

Instructor Resource: *Classroom Activity*

SPREADSHEETS

What are spreadsheets?

A spreadsheet program stores data in a grid of rows and columns and a file in the program may contain multiple worksheets used for organization, analysis, and storage of data in tabular form. Data may consist of numbers, formulas, or text. Spreadsheets have features that enable users to store, analyze, model and visualize data. Common spreadsheets include Microsoft Excel and Google Sheets.

Spreadsheet Competencies

- Creating spreadsheets
- Performing basic functions, including sums and averages
- Manipulating data cells
- Analyzing data
- Organizing and formatting related data
- Sorting data
- Creating charts
- Importing data from an external source

Cross-disciplinary Skills

- Applying computational thinking
- Using basic statistics
- Utilizing analytics tools, such as Excel
- Managing data
- Demonstrating data literacy
- Creating data visualizations
- Communicating the implications of the data

Advanced Manufacturing Scenario

Mohammed is a Manufacturing Technician for a plastics manufacturing company where he works with an injection molding machine. Mohammed uses an HMI, a touch screen with that allows him to control the machine and track various functions, such as the temperature of the molds and the operation of the hoses. Since maintaining machinery is part of his responsibilities, Mohammed needs to periodically collect data that provides insight into the machine's functioning over time to determine when to do preventive maintenance. When Mohammed's company installed the HMI for his machine, they were able to set up a reporting feature where he can download the data directly into an Excel format. He views the data in rows and columns by date and function and uses that information to determine whether maintenance will be needed to ensure his machine is functioning properly.

Engineering Technologies Scenario

Lisa is a Materials Technician in a plasma lab where they are studying how to the shrink the size of chips used in electronics. She is responsible for setting up test fixtures, conducting materials and component tests, and collecting data. Lisa needs to share data on her materials testing with her supervisor weekly. She finds charts the most effective way to visually summarize the data. To accomplish this, she tracks and stores data daily exported to an Excel spreadsheet. On Fridays, Lisa creates charts by highlighting the data she wants to share, clicking on "Insert-Recommended Chart" and then selecting Bar or Pie charts. She then emails them to her supervisor or prints them out before discussing the week's testing results.

Instructor Content

- Activity description
- Warm-up questions
- Activity steps
- Existing resources that can be used for the activity
- Resource links for instructors to expand their knowledge

SPREADSHEETS

Activity

This activity is designed to give students hands-on experience with creating a simple spreadsheet that a technician might use in real life. It can be done in pairs in a classroom or by individual students via distance learning.

Warm-Up

Remind students that technicians collect data as part of their daily workflow to record, organize, and store data. Technicians then can use spreadsheet statistical tools and application features, such as Excel's Power Query or pivot tables (not introduced in this activity), to analyze, combine, and refine the data. Ask students:

- Who has created and/or used Excel spreadsheets?
- What did you use the spreadsheets for?

Activity Steps

1. Have students get into pairs. Each pair needs at least one computer with Excel. If they do not have Excel loaded, students can sign up for a free account at <https://www.microsoft.com/en-us/microsoft-365/free-office-online-for-the-web>.
2. Pairs are going to watch the video [Calculating Wind Power in Excel](#) and create the same spreadsheet as demonstrated in the video. They can stop the video or go back, as needed, so they are able replicate all the steps.
3. The pairs will need to have some basic cells ready in the spreadsheet as shown in the video.
 - a. Click on "new spreadsheet."

- b. Type "Wind Velocity (meters and seconds)" in the first cell.
- c. In column A, type the numbers 1-11 in each cell going downwards.
- d. In column B, type "Wind Power (watts/meter²)."

4. The pairs follow the steps in the video to add the data.
5. Ask students what they learned from the activity about how spreadsheets function.

Tools Available

- Excel is a common spreadsheet program. Users with a school email can set up a [free account](#).
- Google Sheets offers similar tools and is [free to those who have a Google log-in](#).
- On an iPad, Numbers is the free spreadsheet app.

Read More

- [Twelve Best Spreadsheets to Try](#)
- [Is the Age of the Spreadsheet Over?](#)



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ABOUT THE PROJECT

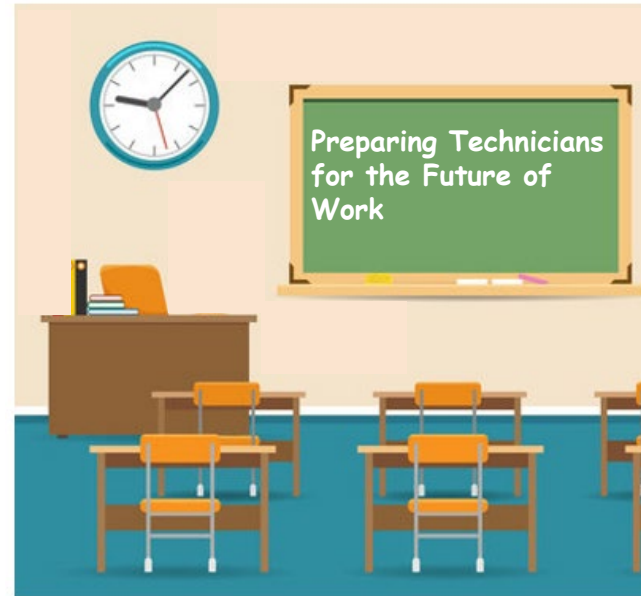
Preparing Technicians for the Future of Work, funded by the National Science Foundation Advanced Technological Education program, recognizes that technicians need an expanded skill set to remain competitive. The project's Framework for a Cross-Disciplinary STEM Core outlines recommendations for incorporating knowledge and skills in Advanced Digital Literacy, Data Knowledge and Analysis, and Business Knowledge and Processes. Learn more about implementing the Framework at preparingtechnicians.org.

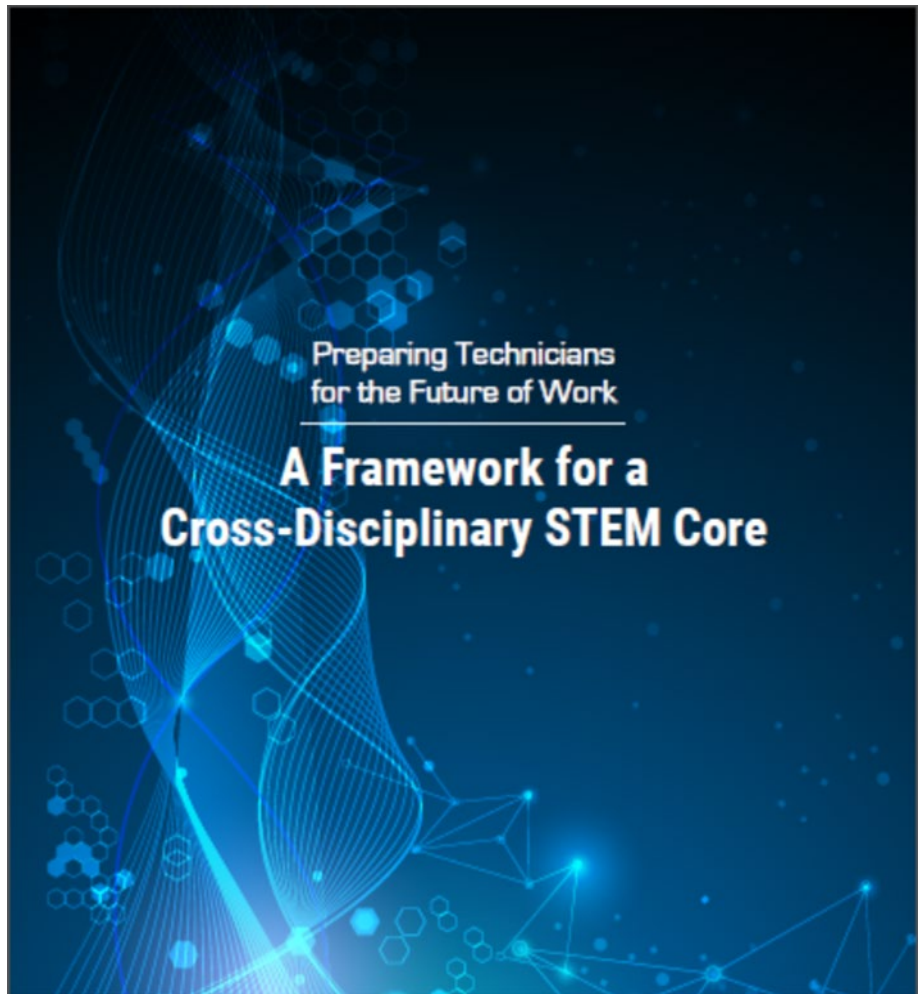
Are you using scenarios?
Are they cross-disciplinary?
How are they developed?

Discussion



Implementing Cross-Disciplinary STEM CORE





Preparing Technicians for the FUTURE OF WORK



<https://www.preparingtechnicians.org/cross-disciplinary-stem-core/>

DATA KNOWLEDGE AND ANALYSIS

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- Data storage
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- Query languages
- Spreadsheets
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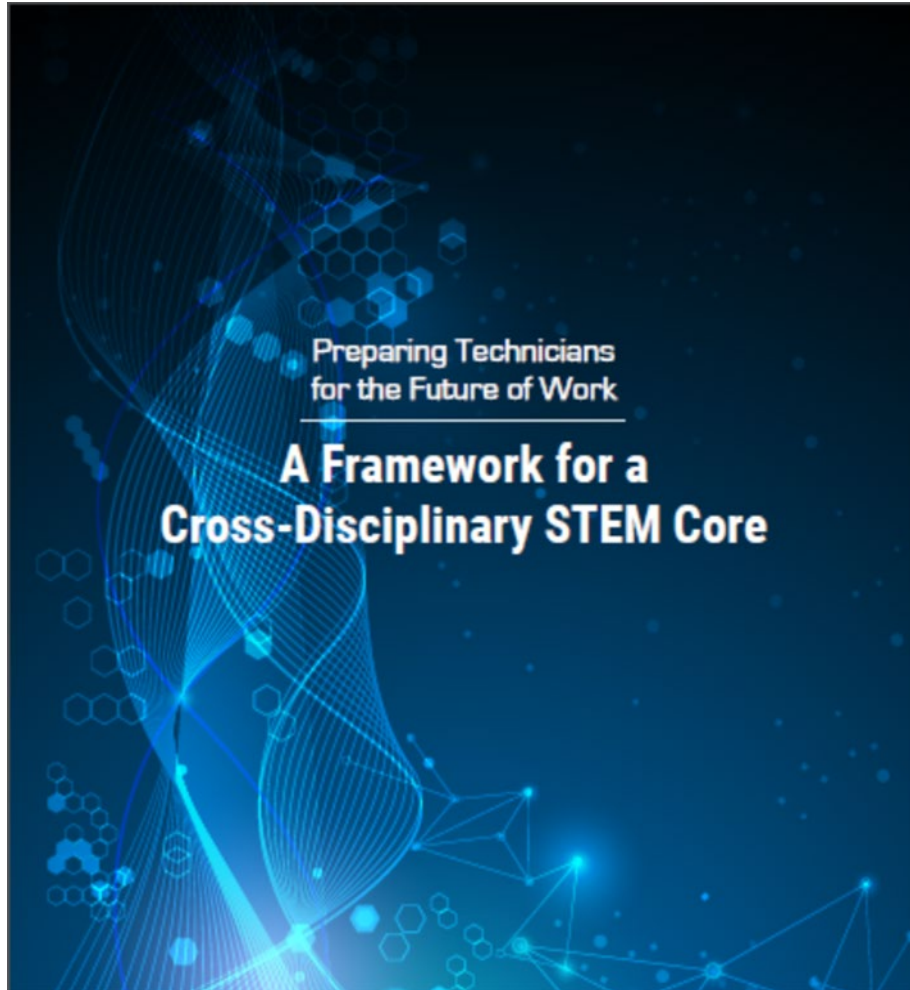
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- Risk management
- Supply and demand
- Vertical and horizontal integration



A Framework for a Cross-Disciplinary STEM Core



Preparing Technicians
for the Future of Work

A Framework for a Cross-Disciplinary STEM Core



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Data Knowledge and Analysis

BUSINESS KNOWLEDGE
AND PROCESSES

Understanding, interpreting, and manipulating data to resolve issues using Excel and other common software proficiency to accomplish tasks.

Data analysis

- Data backup and restoration
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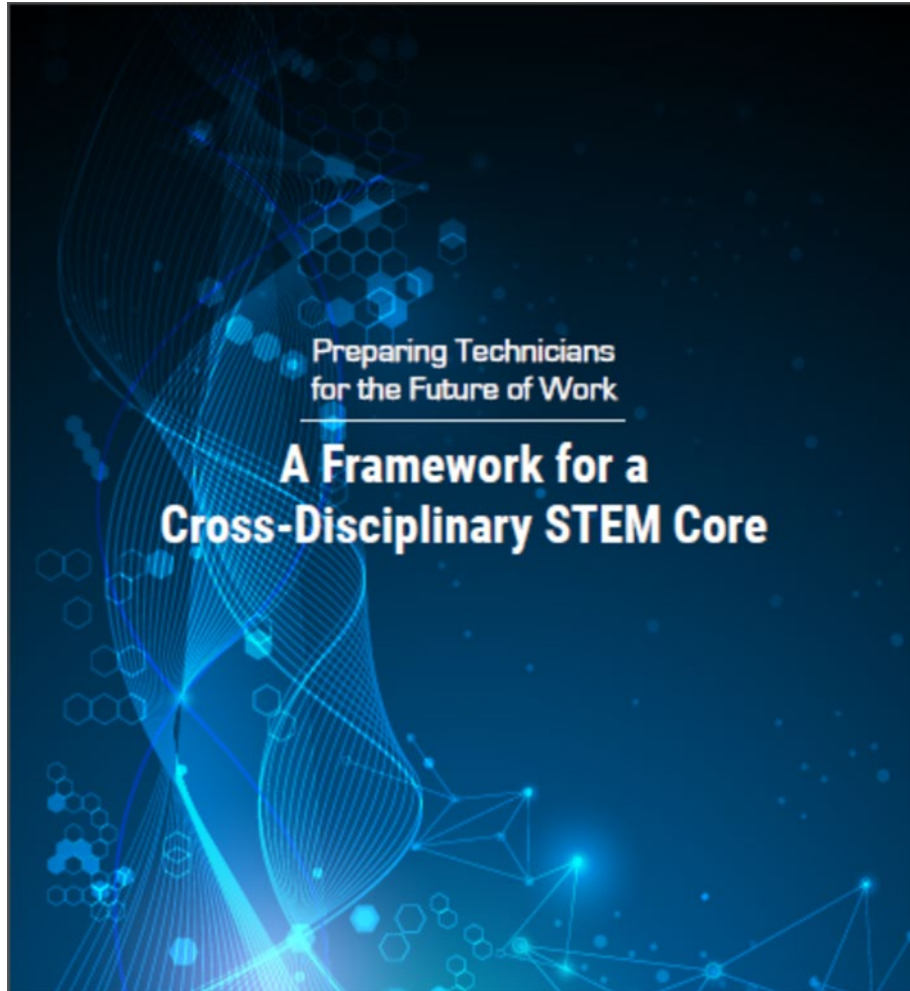
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A Framework for a Cross-Disciplinary STEM Core



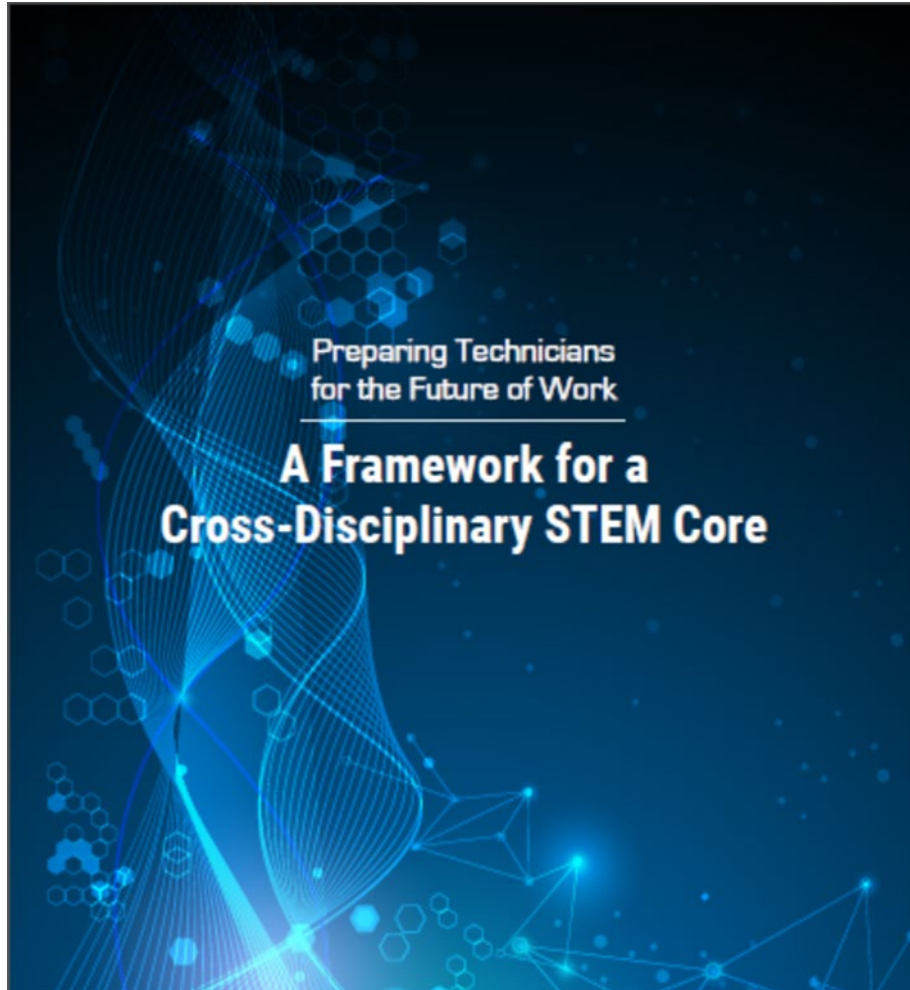
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Advanced Digital Literacy	BUSINESS KNOWLEDGE AND PROCESSES	
<h2>Understanding digital communications and networking, cybersecurity, machine learning, sensor, programming, and robotics at higher than introductory level.</h2>		
<ul style="list-style-type: none">DatabasesData fluencyData life cycleData managementData modelingData storageData visualizationQuery languagesSpreadsheetsStatistics	<ul style="list-style-type: none">Cloud literacyDigital fluencyDigital twinsEdge computingFunction block diagram programmingHuman-Machine Interface (HMI)Internet of Things (IoT)Network architectureNetwork communicationSecurity controls	<ul style="list-style-type: none">Customer/stakeholder analysisEntrepreneurshipEthicsLean processesLogistical chainsMarket trendsOverall Equipment Efficiency (OEE)Return on Investment (ROI)Risk managementSupply and demandVertical and horizontal integration



A Framework for a Cross-Disciplinary STEM Core



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Preparing Technicians for the
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Business Knowledge and Processes

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3 Skill Areas

Skill Sets

Cross-Disciplinary Frameworks

Data Knowledge and Analysis

- Analytics Tools**
- Computational Thinking**
- Data Analysis**
- Data Backup, and Restoration**
- Databases**
- Data Fluency**
- Data Life Cycle**
- Data Management**
- Data Modeling**
- Data Storage**
- Data Visualization**
- Query Languages**
- Spreadsheets**
- Statistics**

<p>... Literacy</p>	<p>Business Knowledge and Processes</p>
<p>... munication ... rity, machine ... ming, and ... ductory</p>	<p>Understand the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies.</p>
<p>... hine Learning</p>	<p>Blockchain</p> <p>Business Cycles</p> <p>Communications</p> <p>Continuous Process Improvement</p> <p>Customer/Stakeholder Analysis</p> <p>Entrepreneurship</p> <p>Ethics</p>
<p>... rograming ... (HMI)</p>	<p>Horizontal and Vertical Integration</p> <p>Lean Processes</p> <p>Logical chains</p> <p>Market Trends</p> <p>Overall Equipment Efficiency (OEE)</p> <p>Return on Investment (ROI)</p> <p>Risk Management</p> <p>Supply and Demand</p>



3 Skill Areas

Skill Sets

Cross-Disciplinary Frameworks

Data Knowledge and Skills	Advanced Digital Literacy	Knowledge and Processes
Understanding, in manipulating data issues using Excel common software accomplish task	Artificial Intelligence/Machine Learning	Value chain and of an ing principles of new
Analytics Tool	Automation/Robotics	
Computational	Basic Programing	
Data Analysis	Digital Twin	
Backup and R	Cloud Literacy	ss Improvement
Databases	Digital Fluency	lder Analysis
Data Fluency	Edge Computing	
Data Life Cycle	Function Block Diagram Programming	tical Integration
Data Managem	Human-Machine Interface (HMI)	
Data Modeling	Internet of Things	Efficiency (OEE)
Data Storage	Network Communications	ent (ROI)
Data Visualiza	Network Architecture	
Query Langua	Security Controls	
Spreadsheets		
Statistics		





Data Knowledge and Analysis	Advanced Digital Literacy
Understanding, interpreting, and manipulating data to resolve issues using Excel and other common software proficiency to accomplish tasks.	Understanding digital computing and networking, cybersecurity, learning, sensors, programming, robotics at higher than intermediate level.
<ul style="list-style-type: none"> Analytics Tools Computational Thinking Data Analysis Backup and Restoration Databases Data Fluency Data Life Cycle Data Management Data Modeling Data Storage Data Visualization Query Languages Spreadsheets Statistics 	<ul style="list-style-type: none"> Artificial Intelligence/ Machine Learning Automation/ Robotics Basic Programming Cloud Literacy Digital Fluency Digital Twin Edge Computing Function Block Diagram Human-Machine Interface Internet of Things Network Architecture Network Communication Security Controls

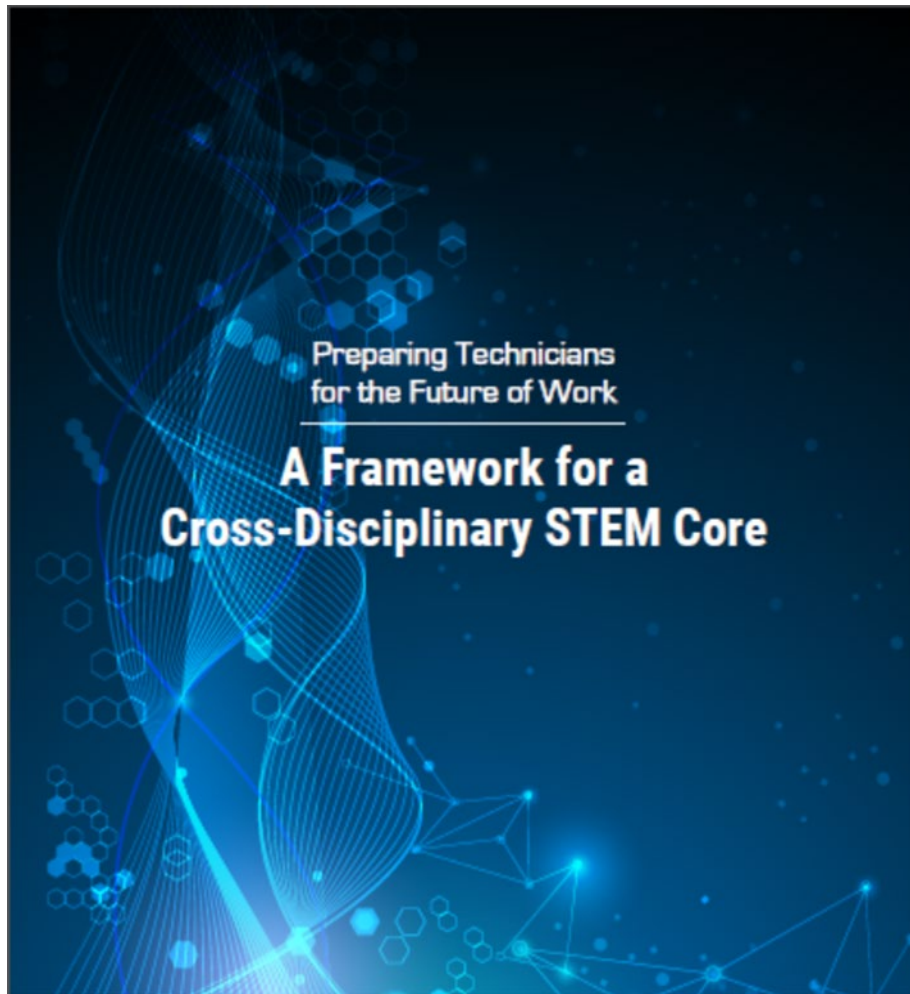


Business Knowledge and Processes

- Business Cycle
- Blockchain
- Communication
- Continuous Process Improvement
- Customer/Stakeholder Analysis
- Entrepreneurship
- Ethics
- Horizontal and Vertical Integration
- Lean
- Processes
- Logical Chains
- Market Trends
- Overall Equipment Efficiency (OEE)
- Return On Investment (ROI)
- Risk Management
- Supply and Demand



A Framework for a Cross-Disciplinary STEM Core



<https://www.preparingtechnicians.org/cross-disciplinary-stem-core/>

DATA KNOWLEDGE AND ANALYSIS

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks

- Analytics tools
- Computational thinking
- Data analysis
- Data backup and restoration
- Databases
- Data fluency
- Data life cycle
- Data management
- Data modeling
- Data storage
- Data visualization
- Query languages
- Spreadsheets
- Statistics

ADVANCED DIGITAL LITERACY

Understanding digital communications and networking, cybersecurity, machine learning, sensors, programming, and robotics at a higher than introductory level

- Artificial intelligence/machine learning
- Automation/robotics
- Basic programming
- Cloud literacy
- Digital fluency
- Digital twins
- Edge computing
- Function block diagram programming
- Human-Machine Interface (HMI)
- Internet of Things (IoT)
- Network architecture
- Network communication
- Security controls

BUSINESS KNOWLEDGE AND PROCESSES

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies

- Business cycles
- Blockchain
- Communication
- Continuous process improvement
- Customer/stakeholder analysis
- Entrepreneurship
- Ethics
- Lean processes
- Logistical chains
- Market trends
- Overall Equipment Efficiency (OEE)
- Return on Investment (ROI)
- Risk management
- Supply and demand
- Vertical and horizontal integration

Data Knowledge and Analysis	Advanced Digital Literacy	Business Knowledge and Processes
<p>Analytics Tools</p> <p>Computational Thinking</p> <p>Data Backup, and Restoration</p> <p>Databases</p> <p>Data Life Cycle</p> <p>Data Fluency</p> <p>Data Management</p> <p>Data Storage</p> <p>Data Modeling</p> <p>Data Visualization</p> <p>Query Languages</p> <p>Spreadsheets</p> <p>Statistics</p>	<p>Artificial Intelligence / Machine Learning</p> <p>Automation/Robotics</p> <p>Basic Programing</p> <p>Cloud Literacy</p> <p>Digital Fluency</p> <p>Digital Twin</p> <p>Edge Computing</p> <p>Function Block Diagram</p> <p>Programming</p> <p>Network Communications</p> <p>Human-Machine Interface (HMI)</p> <p>Industry Internet of Things</p> <p>Network Architecture</p> <p>Security Controls</p>	<p>Blockchain</p> <p>Business Cycle</p> <p>Communication</p> <p>Customer/Stakeholder Analysis</p> <p>Continuous Process Improvement</p> <p>Entrepreneurship</p> <p>Horizontal and Vertical Integration</p> <p>Ethics</p> <p>Lean Processes</p> <p>Logical Chains</p> <p>Market Trends</p> <p>Overall Equipment Efficiency (OEE)</p> <p>Return On Investment (ROI)</p> <p>Risk Management</p> <p>Supply and Demand</p>



**Three Examples:
Basic Programming
Spreadsheets
Lean**



2022 Salt Lake City, UT

Student Resource (front page)

Student Resource (back page)

Advanced Digital Literacy

Student Resource

BASIC PROGRAMMING: PYTHON

Advanced Digital Literacy

Student Resource

BASIC PROGRAMMING: PYTHON

What is Python and how is it related to basic programming?

Basic programming tells a computer what to do using a language (code) it understands. One easy-to-learn programming language is Python. It uses open-source code that can run on a variety of computer systems. Technicians use Python for a variety of applications, including data analysis and visualization, automation, web and mobile app development, software testing and Machine Learning.

Vocabulary

- **Debugging** – the process of finding and removing programming errors
- **Object** – a group of related functions and variables combined into a unit
- **Object-oriented programming** – code written using objects that interact with one another
- **Python Enhancement Proposal (PEP 8)** – a style guide for writing Python code
- **Repository** – a digital archive where all of the files for a project or application are stored along with the history of all changes made to those files
- **Software library** – a digital collection of reusable code developed for specific purposes and shared with programmers
- **Statement** – single line of code written that expresses an action to be carried out

- **String** – a sequence of characters
- **Syntax** – set of rules on how statements can be arranged in order for the program to run
- **Web framework** – a collection of code which allows developers to write web applications more easily

How will technicians use Python for basic programming?

Jamal is Geospatial Information System (GIS) Technician for a civil engineering firm. He is a member of a project team that assists energy and utility clients with where to place power and sewer systems in new commercial developments. Jamal is responsible for the data management and analysis for the team. He had been using Excel but after conducting research on other available tools, he wanted to use Python since it is a more powerful than Excel and is easy to learn. Python has a library called Pandas that is specifically for data management and analysis. Jamal discussed this with the GIS Analyst on the team, who supported this approach. Jamal participated in a coding bootcamp and was able to successfully transition to using Python for his data responsibilities. He found it easy to understand and use and will be demonstrating how he uses Python with the GIS Technicians on other teams at the company.

Skills Needed for a High-Paying Career

- Applying the core concepts of basic programming
- Selecting the Python libraries that match desired outcomes
- Using Python for data analysis
- Thinking critically and asking questions
- Identifying and solving problems
- Communicating effectively with a variety of audiences

Education

Your local community college provides the advanced technology classes you will need. Skills for basic programming and Python are most often taught within Information Technology or Computer Information Systems programs offering associate degrees and one-year certificates. You will also find the skills applicable in technical specializations, such as advanced manufacturing, cybersecurity, biomedical, energy, environmental, and engineering technologies. Community college course schedules are designed to accommodate the needs of working students and often include online and hybrid delivery formats. [Find your nearest community college here.](#)

Future Trends

The future of Python will include using it for:

- **Artificial Intelligence (AI) and Machine Learning (ML)** – With its libraries and frameworks, Python is helping to advance the science of emulating humans
- **Cybersecurity** – Python can perform a multitude of security tasks, protecting critical systems and information from digital attacks
- **Automation** – Python will continue to automate tasks traditionally performed by humans
- **Data science** – With its powerful capabilities, hundreds of libraries and frameworks, using Python for data science will continue to grow
- **Blockchain development** – Python can be used to create a digital public ledger that records online transactions, keeping them secure

Learn More

- [Code Academy's Learn How to Code: Basics of Programming](#)
- [What is Python Used For? A Beginner's Guide](#)



Preparing Technicians for the FUTURE OF WORK



Instructor Resource (front page)

Instructor Resource (back page)

Advanced Digital Literacy

Instructor Resource: Classroom Activity

BASIC PROGRAMMING: PYTHON

What is Basic Programming: Python

Basic programming is the set of instructions given to a computer to solve a problem or carry out tasks. This is done through a language it understands called code. Python is an open-source high level programming language that is free to use for personal or commercial applications and can run on Mac, Windows, Linux, and Unix systems. Python is a beneficial tool for technicians since it is easy to learn and can be used for data analysis and visualization, automating tasks, app development and for writing Machine Learning algorithms.

Basic Program: Python Competencies

- Applying the core concepts of basic programming
- Selecting the Python libraries that match desired outcomes
- Using Python for data analysis
- Thinking critically and asking questions
- Identifying and solving problems

Cross-disciplinary Skills

- Writing basic programming code
- Applying principles of Machine Learning
- Using statistics
- Analyzing and visualizing data
- Communicating effectively with a variety of audiences
- Continuously improving products, services, or processes

Supply Chain and Logistics Scenario

Don is a Logistics Technician at a temperature-controlled warehouse that stores and delivers food products to local social service agencies, hospitals, and school systems. He is responsible for the computer system used for scheduling, assigning, and routing multiple drivers to serve customers with unique priorities, service time windows, processing times, and geographical locations. Don tried using an off the shelf scheduling and routing system, but it was not providing the flexibility he needed. Don was able to develop a highly targeted software application using Python programming that addressed the unique needs of his company. Not only did this help optimize processes, but given that Python is free and open source, it saved his company money from having to use another off the shelf system.

Biotechnology Scenario

Amara is Biotechnology Technician at an oncology laboratory where they are researching cures for cancer. Amara is part of a team that is piloting bioprinting. Bioprinting is a special type of 3D printer that uses cells and natural or synthetic biomaterials to print layers of living tissue. This approach enables the company to test drugs without having to rely on organ donations or test on humans or animals. This is an emerging field and Amara is excited to be part of the team. Given her daily experience with managing and analyzing data, she will be setting the printing parameters and speed, which will need to consider a wide number of variables. She will be using Python programming and researching how she might be able to utilize the PyBioMed library.

Advanced Digital Literacy

Instructor Resource: Classroom Activity

BASIC PROGRAMMING: PYTHON

Activity

This activity is designed to provide students the opportunity to explore options for learning Python programming. They will watch a video, read an article, discuss how technicians are using Python, and then select an option for learning Python programming if they choose.

Warm-Up

Review the definition and basic terms for Basic Programming – Python. Have students watch [What is Python? Why is it so Popular?](#) Ask the students if they have tried Python programming, and if so, to share their experiences. Discuss how technicians such as those depicted in the scenarios use Python and ask whether students have seen Python used in their fields of study.

Activity Steps

1. Explain that for learning a programming language, our learning styles vary. Some people prefer learning independently through tutorials or videos, whereas others may want to take a class online or in person. Students will have the opportunity to explore options and select one that would be the best match should they need or want to learn Python programming.
2. Have students read [Top 13 Resources to Learn Python Programming](#) all the way through.
3. Next, have students skim over the 13 resources and jot down 2-3 that align to their learning style and level of experience with Python programming.

4. For each of the 2-3 selections, student should go to the websites and explore what each approach has to offer.
5. Students select one that is the best match.
6. In groups of 3-4, have students share and explain their best approach for learning Python.

Tools Available

- [Python Tutorial Topics](#)
- [Microsoft's Python for Beginners](#) (free video series)
- [Code Academy's Learn Python 3](#)

Read More

- [What Is Python Used For: 10+ Coding Uses for the Python Programming Language](#)
- [Why Learn Python? Six Reasons It's So Hot Right Now](#)

Advanced Digital Literacy Instructor Resource: Classroom Activity

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Front page of Instructor's card

Competencies/Skills

- Apply Appropriate Python Library
- Apply Appropriate Python Functions
- Ask appropriate Situation Questions
- Execute Critical Thinking to Isolate Scenario specifics
- Import Data from Multiple Sources
- Perform Successful Data analysis with Python tools
- Successfully Identify and Correct Scenario Problems

Cross-discipline Skill Sets

- Artificial Intelligence/ Machine Learning
- Basic Programming
- Communications
- Continues Process Improvement
- Data Visualization
- Statistics

Data Knowledge and Analysis	Advanced Digital Literacy	Business Knowledge and Processes
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Advanced Digital Literacy

Instructor Resource: *Classroom Activity*

BASIC PROGRAMMING: PYTHON

What is Basic Programming in Python?

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amazonjobs

Amazon is offering teams more flexibility on where to work. [Read more](#) from Amazon CEO, Andy Jassy.

Operations, IT, & Support Engineering

5012 open jobs

Building the system that runs it all

Corporate Operations can't happen without networks and IT, and Amazon has a massive infrastructure to connect and support. Qualified IT and networking specialists are the way we ensure that we're able to keep all of Amazon running, 24/7/365.

Some common IT & Engineering positions:

- IT Technician
- IT Systems Engineer
- Network Engineer
- Technical Support Engineer
- Network Support Engineer
- Cloud Support Engineer

Supply Chain and Logistics Situation:

Technician works in an Amazon temperature-controlled warehouse Supply Chain and Logistics Situation with responsibilities that include;

Computer system used for assigning, scheduling, routing technicians to address customer needs.

Supply Chain and Logistics Scenario:

Technician is using Python to develop highly targeted application to address unique customer (in the company and outside the company) needs.

Biotechnology Situation

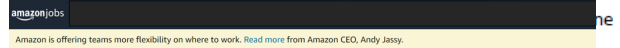
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Operations, IT, & Support Engineering 5012.com

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Johns Hopkins University

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Technician works in an Amazon temperature-controlled warehouse Supply Chain and Logistics Situation with responsibilities that include;

Computer system used for assigning, scheduling, routing technicians to address customer needs.

Supply Chain and Logistics Scenario:

Technician is using Python to develop highly targeted application to address unique customer (in the company and outside the company) needs.

Biotechnology Situation

Technician works in a Johns Hopkins Oncology laboratory and is piloting a bioprinting application for cancer treatment protocol.

Biotechnology Scenario

Technician is using Python to develop application to set printer parameters and incorporate the PyBioMed Library for functions to use as analysis tools.

Data Knowledge & Analysis Instructor Resource: *Classroom Activity*

SPREADSHEETS

What are spreadsheets?

A spreadsheet program stores data in a grid of rows and columns and a file in the program may contain multiple worksheets used for organization, analysis, and storage of data in tabular form. Data may consist of numbers, formulas, or text. Spreadsheets have features that enable users to store, analyze, model and visualize data. Common spreadsheets include Microsoft Excel and Google Sheets.

Spreadsheet Competencies

- Creating spreadsheets
- Performing basic functions, including sums and averages
- Manipulating data cells
- Analyzing data
- Organizing and formatting related data
- Sorting data
- Creating charts
- Importing data from an external source

Cross-disciplinary Skills

- Applying computational thinking
- Using basic statistics
- Utilizing analytics tools, such as Excel
- Managing data
- Demonstrating data literacy
- Creating data visualizations
- Communicating the implications of the data

Advanced Manufacturing Scenario

Mohammed is a Manufacturing Technician for a plastics manufacturing company where he works with an injection molding machine. Mohammed uses an HMI, a touch screen with that allows him to control the machine and track various functions, such as the temperature of the molds and the operation of the hoses. Since maintaining machinery is part of his responsibilities, Mohammed needs to periodically collect data that provides insight into the machine's functioning over time to determine when to do preventive maintenance. When Mohammed's company installed the HMI for his machine, they were able to set up a reporting feature where he can download the data directly into an Excel format. He views the data in rows and columns by date and function and uses that information to determine whether maintenance will be needed to ensure his machine is functioning properly.

Engineering Technologies Scenario

Lisa is a Materials Technician in a plasma lab where they are studying how to the shrink the size of chips used in electronics. She is responsible for setting up test fixtures, conducting materials and component tests, and collecting data. Lisa needs to share data on her materials testing with her supervisor weekly. She finds charts the most effective way to visually summarize the data. To accomplish this, she tracks and stores data daily exported to an Excel spreadsheet. On Fridays, Lisa creates charts by highlighting the data she wants to share, clicking on "Insert-Recommended Chart" and then selecting Bar or Pie charts. She then emails them to her supervisor or prints them out before discussing the week's testing results.

Competencies/Skills

- Analyze Appropriate Data Proficiently
- Create Applicable Charts
- Create Spreadsheets
- Import Data from Multiple Sources
- Manipulate Data Cells
- Organize/Format Related Data
- Perform Parameter (sum, average, mean) Calculations

Cross-discipline Skill Sets

- Computational Thinking
- Communications
- Data Fluency
- Data Management
- Data Visualization
- Excel Applications
- Statistics

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Cross-disciplinary Skills

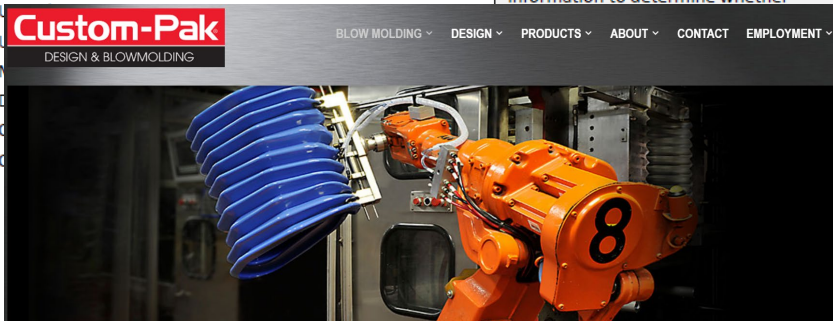
- Applying computational thinking

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Advanced Manufacturing Situation:

Technician works for Custom-Pak manufacturing company with responsibilities that include;
Monitoring and maintaining equipment and scheduling preventive maintenance events.

Advanced Manufacturing Scenario:

The company installed a smart HMI to report data compatible with an Excel spreadsheet. Technician is assigned to complete that programming interface.

Engineering Technology Situation

Technician works for Analog Devices a company that builds sensors on smaller substrates with responsibilities that include;
Assembling test fixtures, analyzing material parameter test results, and generating reports for management.

Engineering Technology Scenario

Management wants an effective easy way to share reporting mechanisms that can accommodate e-mail delivery of data presented as charts and graphs.



Business Knowledge & Processes Instructor Resource: *Classroom Activity*

LEAN PROCESSES

What are Lean Processes?

Lean processes are design to help businesses identify and eliminate waste, focus on the activities that create value for the customer, and ultimately, increase company profitability. The approach is based on the idea of continuous improvement and involves ongoing process adjustments to achieve better quality and flow, less time and effort, and lower cost.

Lean Processes Competencies

- Analyzing data to ascertain what customers value
- Following company business processes
- Staying current with technological advancements
- Thinking creatively about how to solve problems
- Communicating effectively
- Demonstrating teamwork

Cross-disciplinary Skills

- Selecting and utilizing appropriate analytics tools
- Conducting stakeholder analyses
- Instituting continuous process improvement
- Calculating Overall Equipment Efficiency (OEE)
- Communicating with internal and external stakeholders

Supply Chain and Logistics Scenario

Ezra is a Logistics Technician for a food supply chain company that provides warehousing and transportation services to restaurants, schools, and retail companies. Ezra is responsible for continuous process improvements in the warehouse. Ezra learned about an automation software program that would be a breakthrough improvement in helping the company better track their inventory without having to rework other processes or the layout of the warehouse. Radio Frequency Identification Data (RFID)-enabled plastic pallets would replace the company's current pallets. These special pallets have RFID tags inserted. RFID provides real-time visibility and location data specific to warehouse aisles, shelves, and shelf level locations. RFID would allow Ezra to track not just pallets and boxes, but the contents inside the boxes as well. RFID are a wireless technology, so Ezra does not need to do any scanning, making this an automated process. Ezra's company has been using the new pallets for one month and is already realizing more efficient inventory management and less waste.

Information Technology Scenario

Mariana is a Network Technician for a small construction company that is part of a network of local companies committed to Lean construction. The company was continuously seeking business process improvements to ensure customers receive the highest quality services at the best rates. Mariana knew her company would benefit from a new server given theirs was nearly five years old. Mariana researched the Environmental Protection Agency's (EPA) enterprise server efficiency levels product information on the Energy Star web site to inform their purchase of a new server. The Energy Star servers included must be priced no more than \$118 than a less efficient model. An efficient product is cost-effective when the lifetime energy savings (from avoided energy costs over the life of the product, discounted to present value) exceed the additional up-front cost (if any) compared to a less efficient option. Servers have become higher performance and more efficient the past 3-4 years; therefore, the company could expect the savings to be even greater.

Competencies/Skills

- Accurate Analysis of Customer data
- Communicate Improvements Practices Effectively
- Demonstrate Compliance with Company Processes
- Effectively Execute Creative Thinking Problem Solving
- Proactive Engagement in Teamwork Efforts

Cross-discipline Skill Sets

- Analytics Tools
- Communications
- Continuous Process Improvement
- Customer/Stakeholder Analysis
- Overall Equipment Efficiency

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Business Knowledge & Processes Instructor Resource: *Classroom Activity*

LEAN PROCESSES

What are Lean Processes?

Lean processes are design to help businesses identify and eliminate waste, focus on the activities that create value for the customer, and ultimately, increase company profitability. The approach is based on the idea of continuous improvement and involves ongoing process adjustments to achieve better quality and flow, less time and effort, and lower cost.

Lean Processes Competencies

- Analyzing data to ascertain what customers value
- Following company business processes
- Staying current with technological advancements
- Thinking creatively about how to solve problems
- Communicating effectively
- Demonstrating teamwork

Cross-disciplinary Skills

- Selecting and utilizing appropriate analytics tools
- Conducting stakeholder analyses
- Instituting continuous process improvement
- Calculating Overall Equipment Efficiency (OEE)
- Communicating with internal and external stakeholders

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Supply Chain and Logistics Situation

Technician works at a US Foods Inc. with responsibilities that include;

Continuous Process Improvement.

Supply Chain and Logistics Scenario

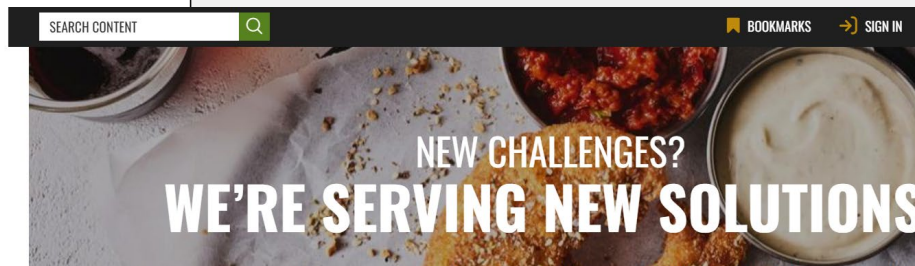
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Information Technology Situation



GREAT FOOD

Innovative food, culinary equipment, trends and events



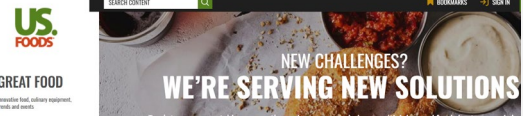
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- Staying current with technological advancements
- Thinking creatively about how to solve problems
- Communicating effectively
- Demonstrating teamwork

Cross-disciplinary Skills

- Selecting and utilizing appropriate analytics tools
- Conducting stakeholder analyses
- Instituting continuous process improvement
- Calculating Overall Equipment Efficiency (OEE)
- Communicating with stakeholders

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Information Technology Situation

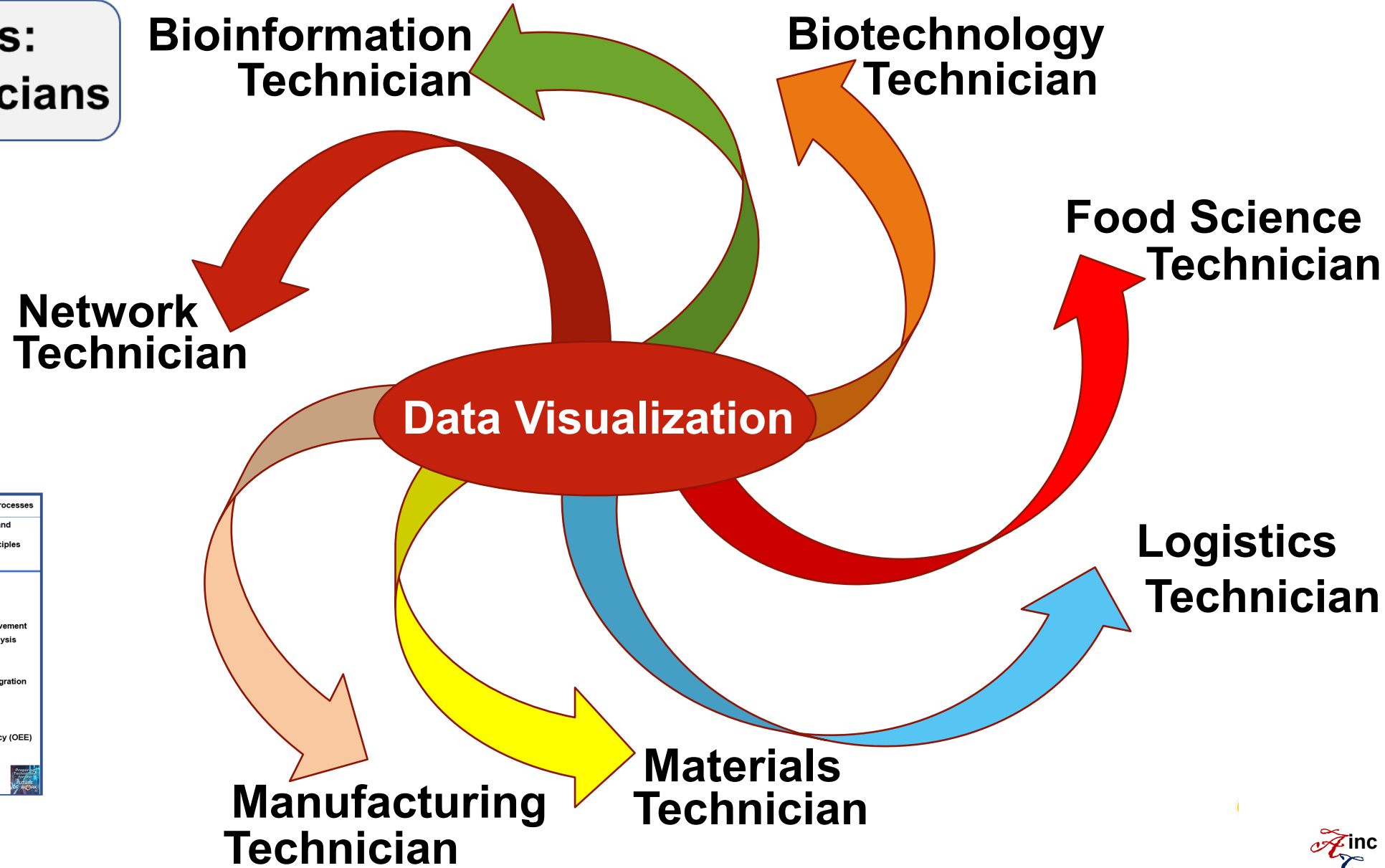
Technician works for Barger Builders with responsibilities that include;

Business Process Improvement for Customer Satisfaction.

Information Technology Scenario

Technician must recommend and ultimately install a new server that is cost effective and compatible with the other construction companies within their local area network.

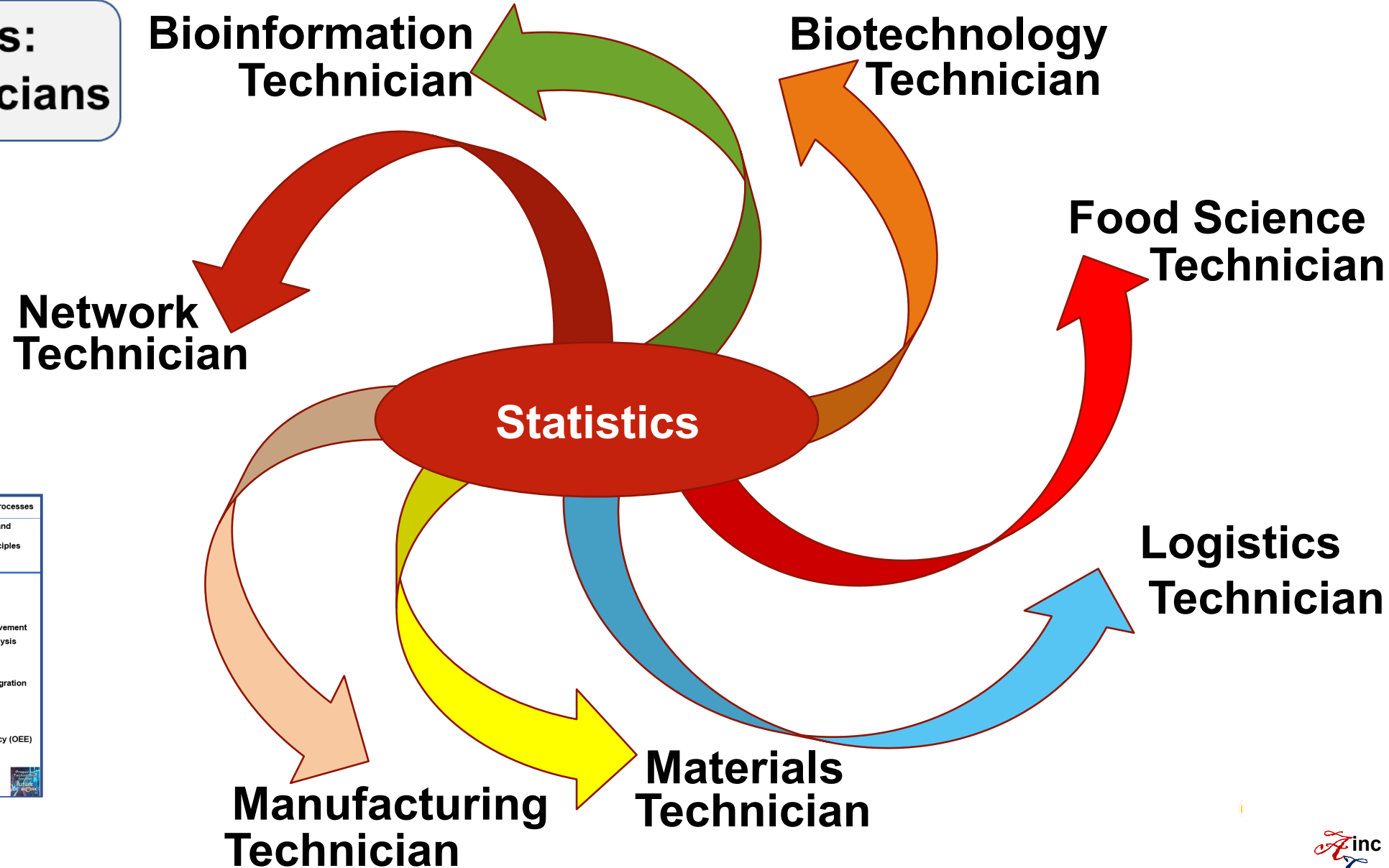
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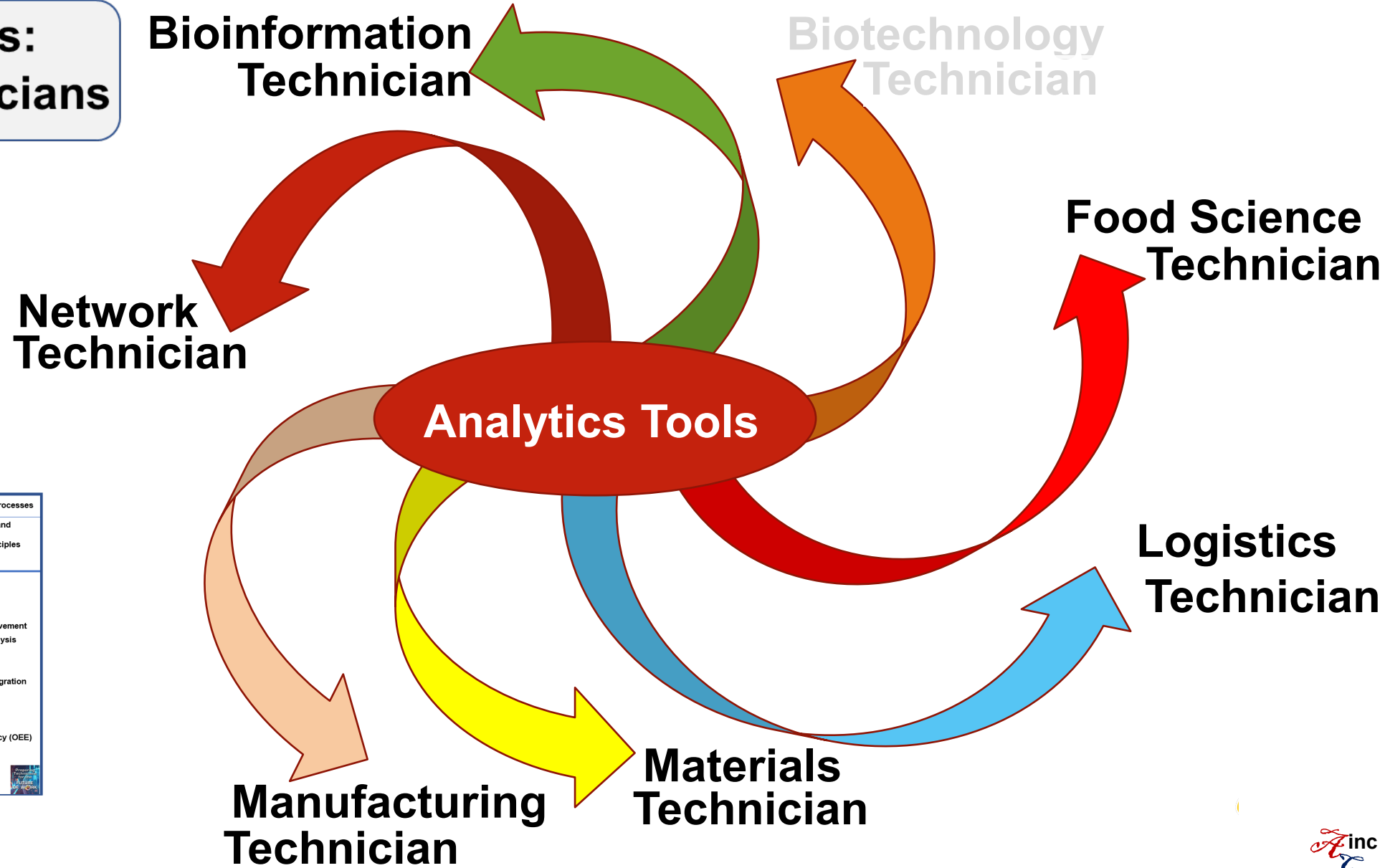


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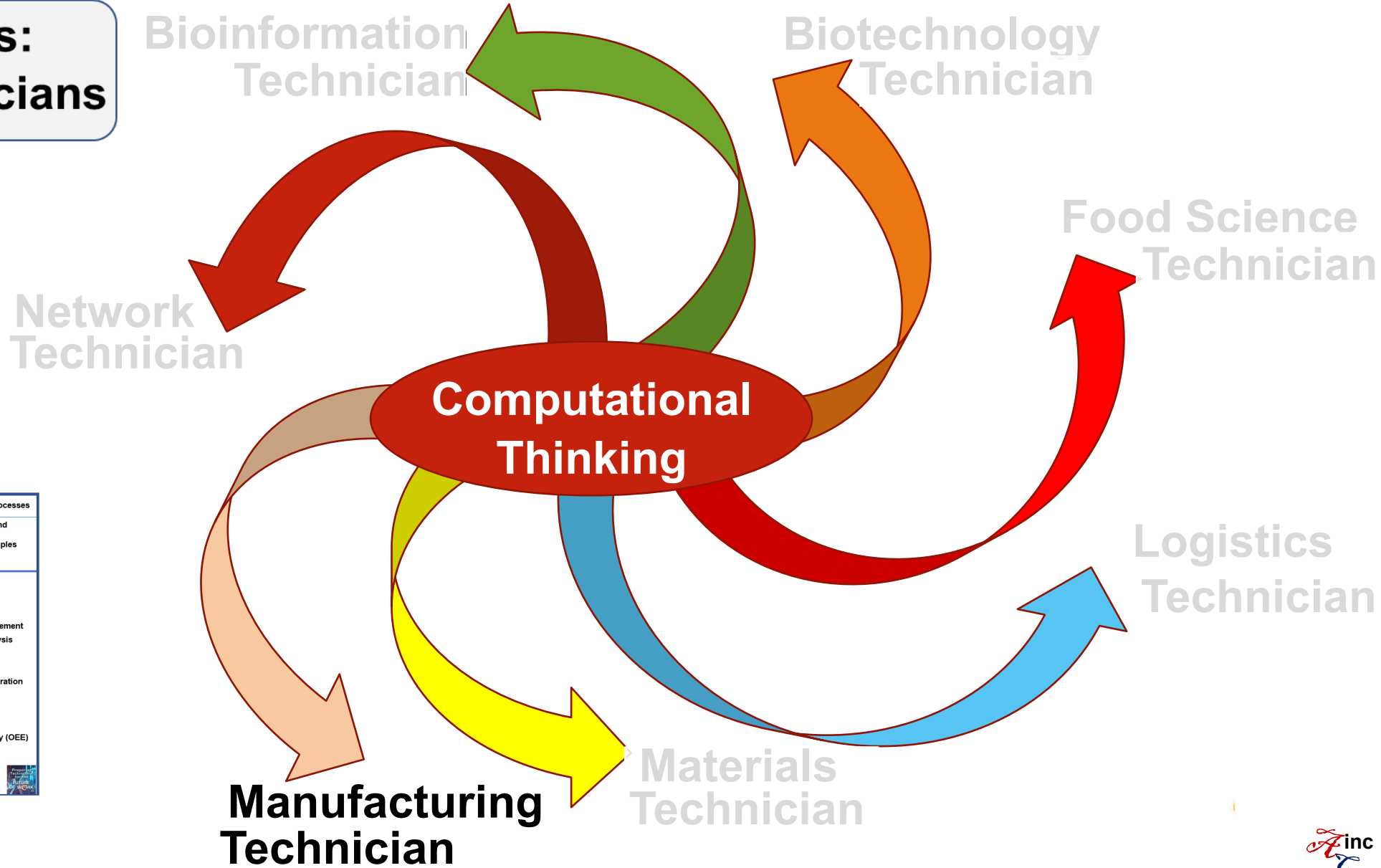
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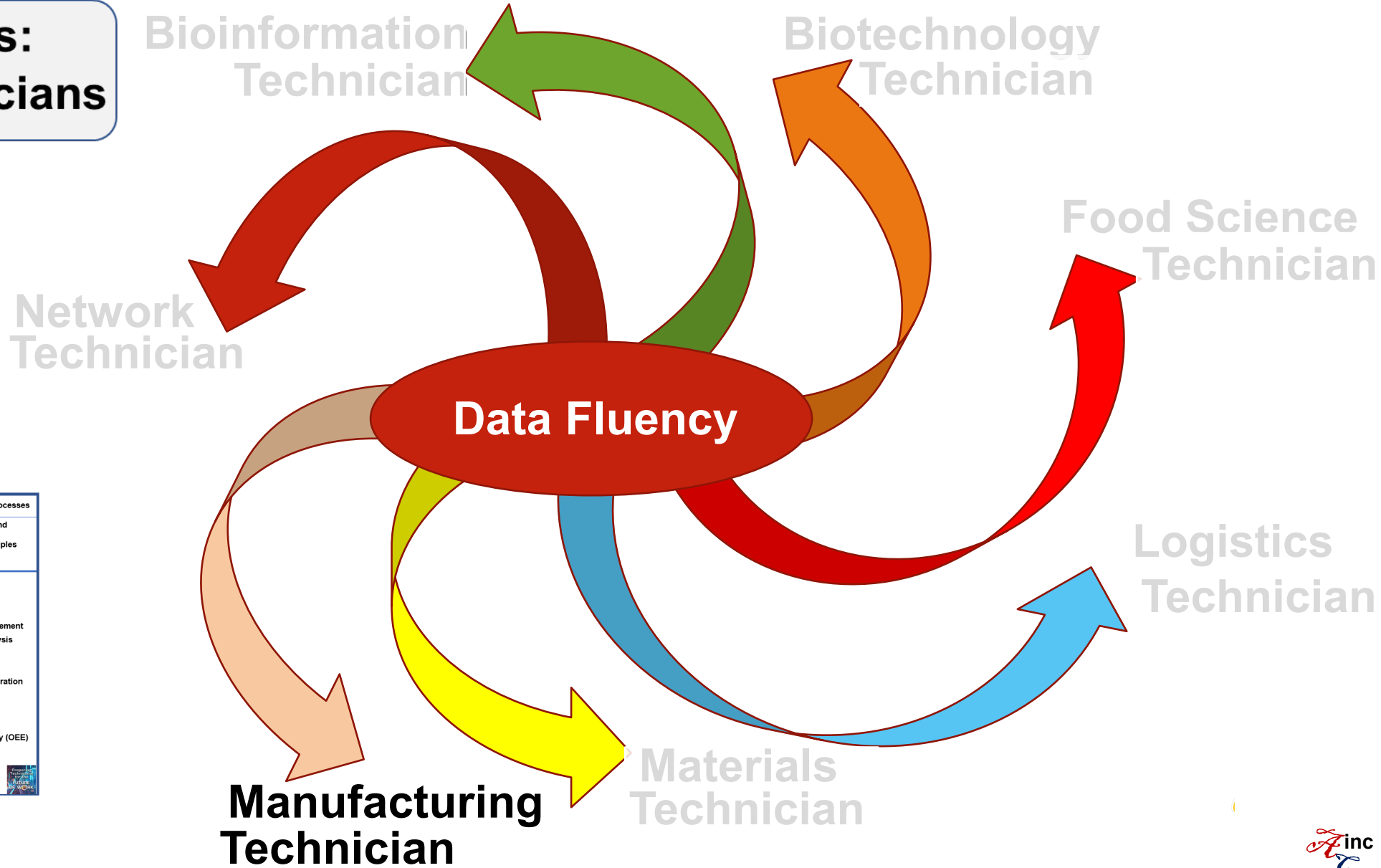


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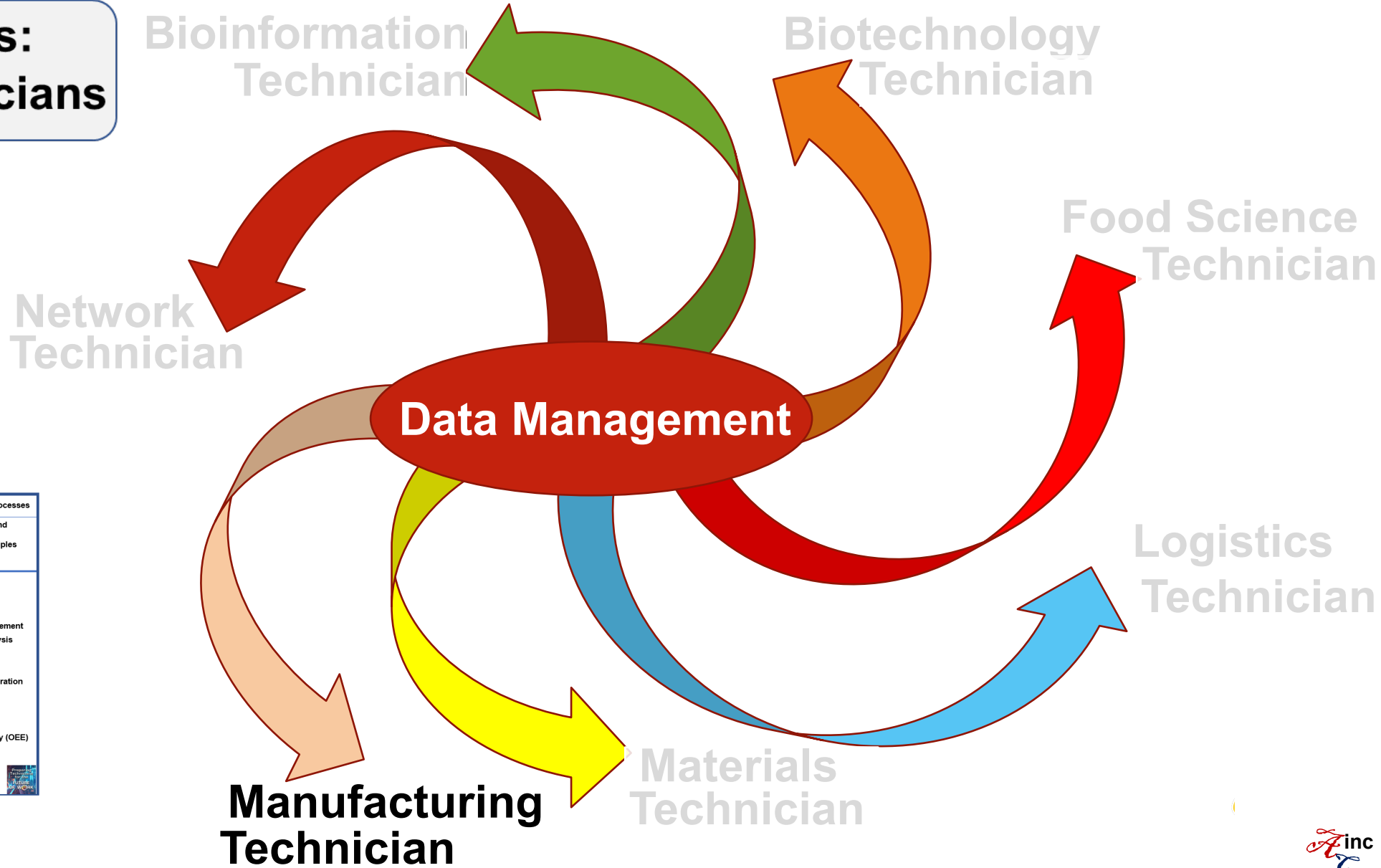
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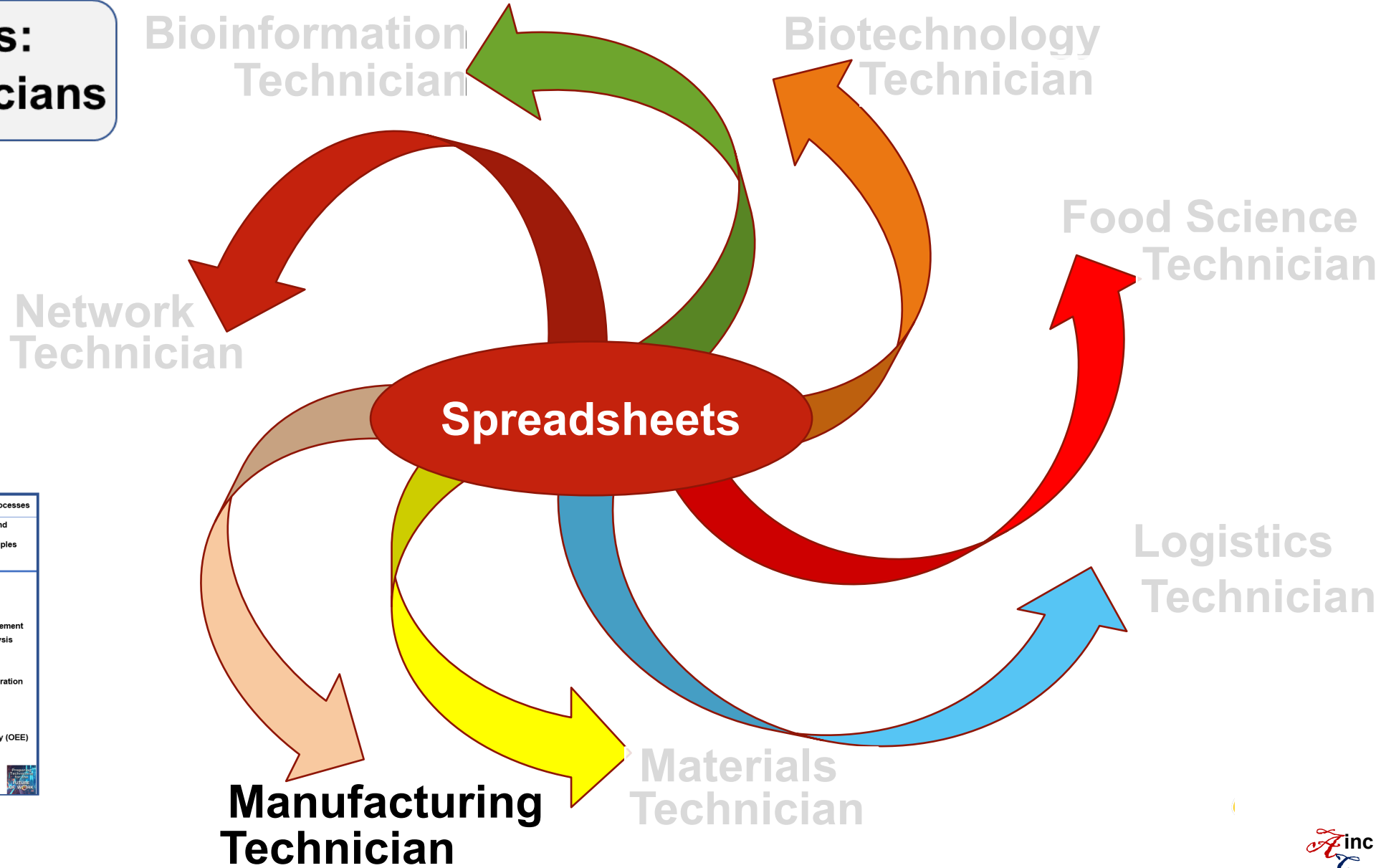


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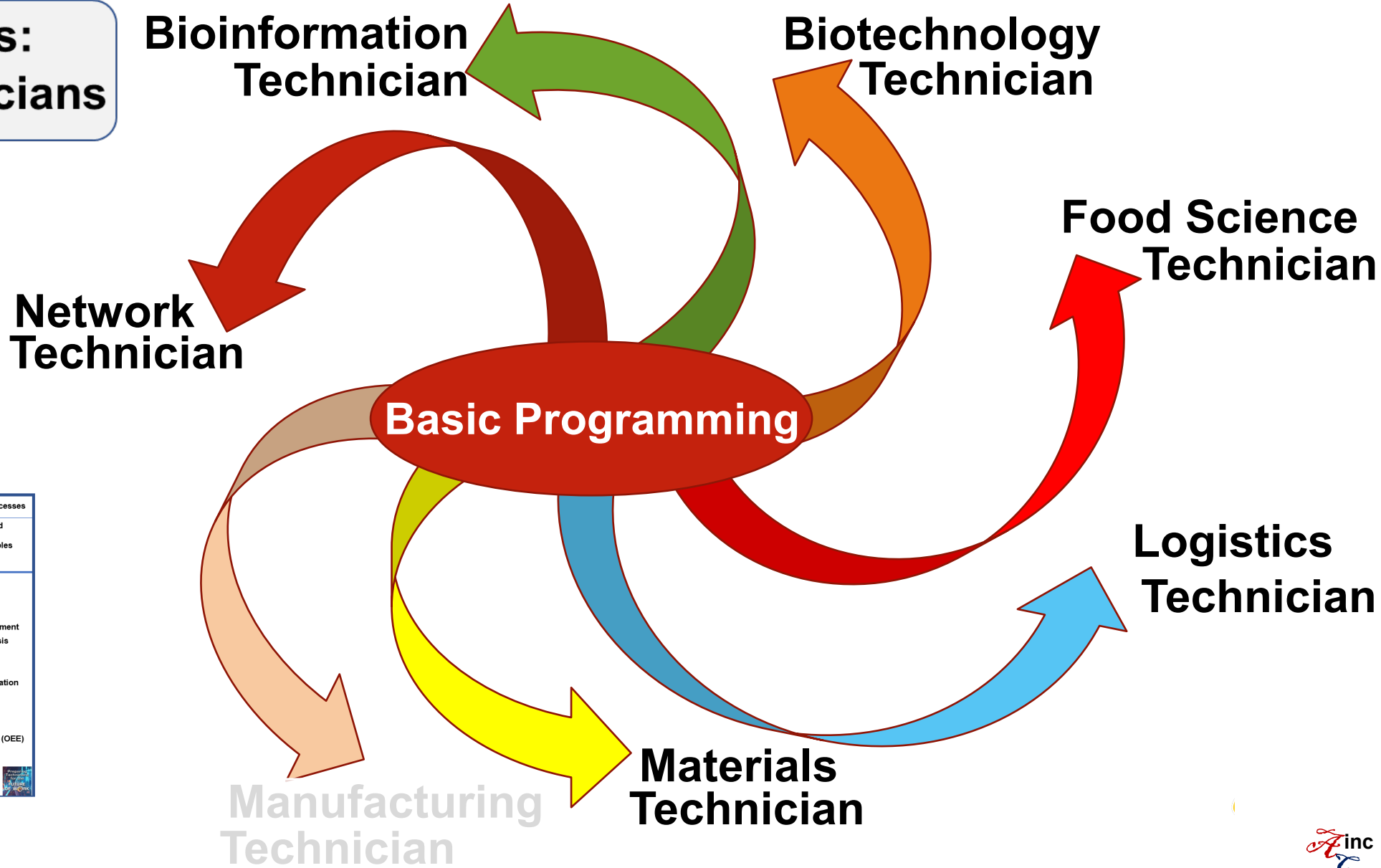
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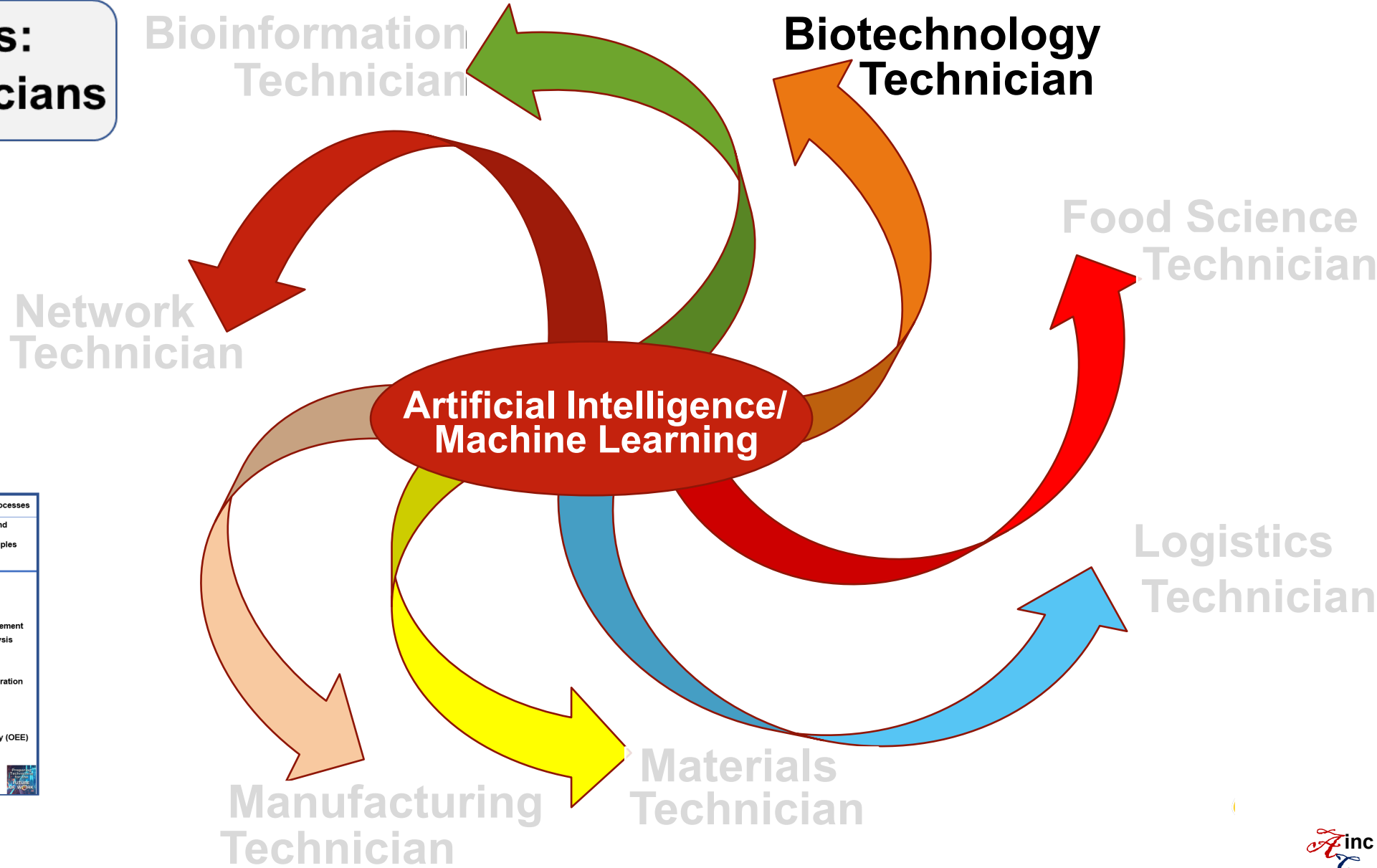


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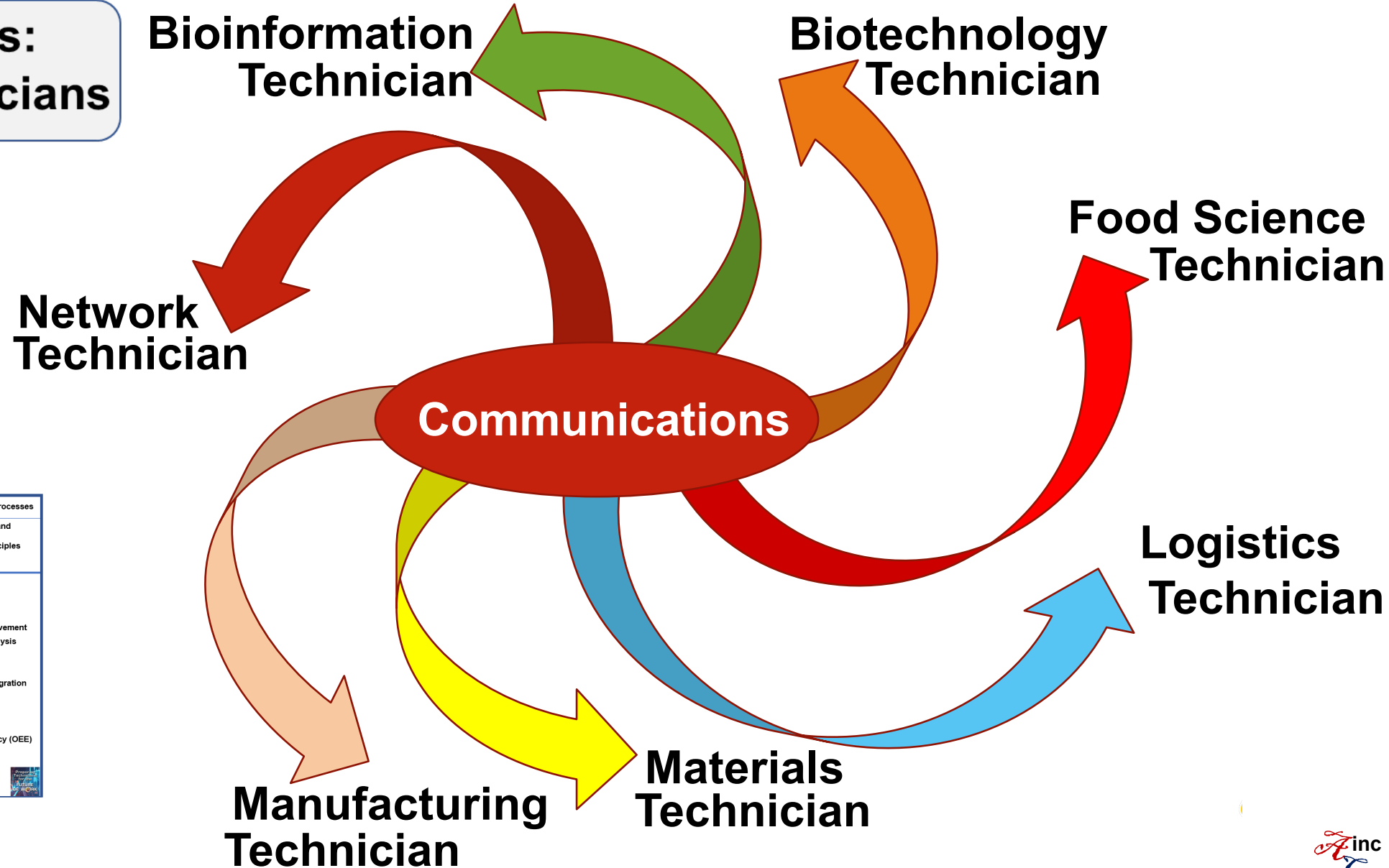
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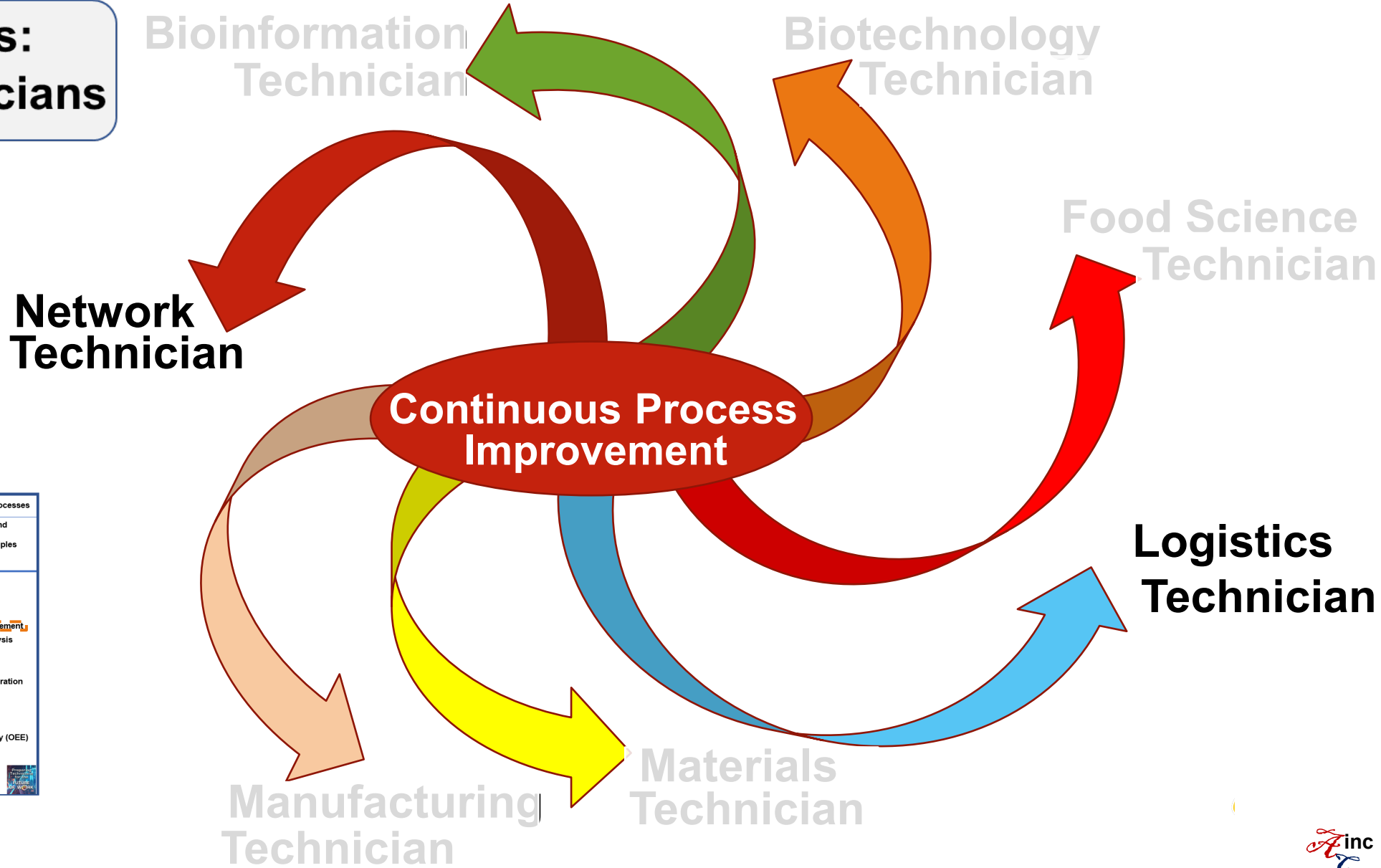
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**Sample from 5 cards:
Technician and Skill Sets**

Bioinformation Technician	Biotechnology Technician	Food Science Technician	Logistics Technician	Manufacturing Technician	Materials Technician	Network Technician
Data Visualization Statistics	Data Visualization Statistics Analytics Tools	Data Visualization Statistics Analytics Tools	Data Visualization Statistics Analytics Tools	Data Visualization Statistics Analytics Tools Data Fluency Data Management Spreadsheets	Data Visualization Statistics Analytics Tools	Data Visualization Statistics Analytics Tools
Programming AI and ML	Programming	Programming	Programming		Programming	Programming
Communications	Communications	Communications	Communications Continuous Process Improvement	Communications	Communications	Communications Continuous Process Improvement

Implementing Cross-Disciplinary STEM CORE

In the Classroom:

Share Student Instruction Cards with students and discuss.

Ask them to discuss in small groups:

- **Card situations**
- **Card scenarios**

Students develop and share alternative situations and scenarios.

Students perform Classroom Activity(s) on Instructor Card(s).

Implementing Cross-Disciplinary STEM CORE

Outside the Classroom

Meet with colleagues from related programs in your college to develop robust scenarios.

Co-teach the Framework Skill Sets with a colleague from another discipline:

- **Focus on scenarios in different disciplines**

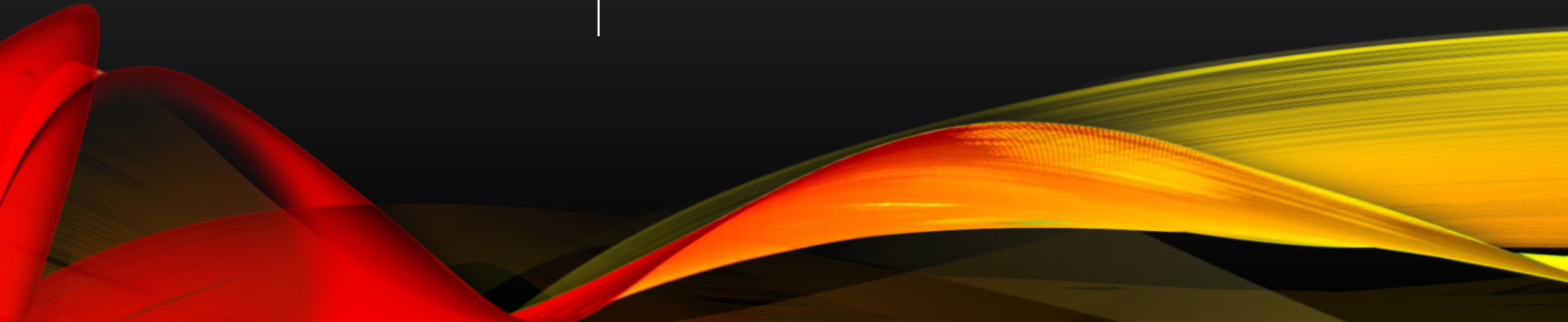
Bring classes together from different disciplines to:

- **Learn how Sub-sets of Skill Set “look” in various disciplines**



TABLETOP
ACTIVITY

Telling your story:
Developing Cross-
Disciplinary Scenarios



Scenario Parameters

1. Provides a realistic story that situates the problem/lesson in the advanced technology workplace (e.g. advanced manufacturing, ag, biotech, autonomous, energy, environmental, engineering, geospatial, IT, cybersecurity, micro/nanotech, etc.)
2. Requires a cross-disciplinary approach integrating at least one of the Cross-Disciplinary STEM Core skill sets
3. Asks students to examine a complex situation and think critically to address an issue or resolve a problem.
Ex: Asking Advanced Manufacturing students to address an automation problem is expected; asking students in Environmental Technologies to address automation/robotics may fall outside their comfort zone



Report Out

One reporter per table shares scenario





Planning to Integrate Cross-Disciplinary Skill Sets

Goals For Card Implementation

- Goal 1: Collect feedback on the integration *process*
- Goal 2: Progress toward broader adoption of the *Framework for a Cross-Disciplinary STEM Core*



Continuum of Cross-Disciplinary Collaboration

Level 1: Great Starting Point

- Use existing resources
- Teach the content yourself
- Introduce students to cross-disciplinary thinking with scenarios

Requires less time and fewer resources

Level 2: Expands Cross-Disciplinary Teaching

- Work with a faculty member in a different discipline
- Team teach an existing card
- Highlight examples of the skill area being used in each other's field

Requires more time

Level 3: Truly Cross-Disciplinary

- Work with faculty in a different discipline
- Co-develop cross-disciplinary scenarios
- Design project-based learning
- Bring employers from different fields to the table

Requires more time and resources



Post-Workshop Activities

- Implement an instructional card at Level 1 in the Fall semester
- Implement an instructional card at Level 2 in the Spring semester
- Provide feedback on the integration process in a virtual focus group (and evaluator interview, if selected).
- Attend webinar on adoption of the *Framework for a Cross-Disciplinary STEM Core*.



Let's Get Started!

Review Cards on Workshop Webpage
preparingtechnicians.org/hitec-workshop/

1. Data Visualization
2. Data Literacy/Fluency
3. Spreadsheets
4. Analytics Tools
5. Network Communications
– Internet of Things
6. Automation/Robotics/HMI
7. Basic Programming-
Python
8. Digital Twins
9. Network Architecture
10. AI and Machine Learning
11. Entrepreneurship
12. Communication
13. Lean Processes
14. Supply and Demand



Select a Card for Level 1 Implementation

Access the [Google Form](#) from the Workshop Webpage

- Select the card to implement in appropriate courses.
- Participants from the same college should select different cards
- Use “scenario thinking” to brainstorm integration points. Where are some points at which content from the cross-disciplinary STEM core overlaps the technical course content?
- Complete the Google form, indicating:
card selected, integration points, course content/format, estimated number of students, timeframe for implementation Fall 2022, etc.



Share Your Plans

- Table discussion about implementation plans, as time permits
- Faculty report out individually:
 - What card did you pick? Why?
 - Which skill set are you integrating and where does it fit?
 - What opportunities and challenges do you foresee?



Next Steps

- Confirm timeframe for card implementation and submit dates
- Implement card at Level 1 and document process and results
- Participate in virtual focus group (implementation debrief)
- If selected, participate in evaluator interview
- Attend webinar on further steps toward adoption of the Framework (invite colleagues)
- Select card for implementation at Level 2



Consider...

Full Adoption of the Framework:

- Work with employers to prioritize cross-disciplinary skill sets for the region
- Determine curriculum gaps and integration points
- Develop real-world scenarios based on employer input
- Provide professional development/promote awareness
- Encourage systemic change



Hey, there's a tool for that!

preparingtechnicians.org

1. Cross-Disciplinary STEM Core
 - Framework, Glossary, and Instructional Cards
2. Over 40 Podcasts with Quotable Content
 - What Educators Should Know and Do about Preparing Technicians for the Future of Work
3. Professional Development Webinars
4. Concrete Steps for Adopting The Framework for a Cross-Disciplinary STEM Core
 - Toolkit, Faculty & Employer Presentations, Employer Meeting Planners, Skill Set Rating Tools, Scenario Development Questions, Professional Development Personal Needs Assessment



Travel Reimbursement

- Hotel room, other than incidentals, has been master billed to our project
- Travel expenses including food on travel days will be reimbursed by your college through its usual procedures. We have provided funds for them to do this. Please keep itemized receipts if required.



Workshop Feedback

https://www.surveymonkey.com/r/HITEC_PtFOW_T

