HAMPDEN COUNTY WORKFORCE BOARD

FRANKLIN HAMPSHIRE WORKFORCE BOARD

Workforce Development

And

Technology Adoption Report

Findings and Recommendations

August 2022

The ***2022 Workforce Development and Technology Adoption Report*** is a part of the on-going implementation of the Regional Planning strategies and goals codified in the **Pioneer Valley Labor Market Blueprint- 2018-2022,** produced by the MassHire Workforce Boards of Hampden and Franklin Hampshire Counties.

The MassHire Workforce Boards currently receive funding for their manufacturing related programs and initiatives from the Massachusetts Technology Collaborative and the Massachusetts Division of Apprentice Standards. Funding for Regional Planning is provided by the Massachusetts Executive Office of Labor and Workforce Development (EOLWD).

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Table of Contents

Introduction

Overview

Executive Summary

Section I- Market Segmentation and Business Trends 1

Section II- Workforce Needs 6

Section III- Manufacturing Operations 18

Section IV- Technology/Innovation Priorities 23

Section V- Education Initiatives 26

Appendix

INTRODUCTION

Technology enabled advanced manufacturing is a priority industry sector in the Pioneer Valley Region of Massachusetts. The advanced manufacturing companies are primarily small and medium sized enterprises (SMEs) that are part of a supply chain that is primarily engaged in producing precision mechanical parts, components, and sub-assemblies utilizing high technology equipment, lean manufacturing, and world class technology development.

The broader regional advanced manufacturing sector is characterized economically as part of the "Knowledge Corridor" (Figure 1), a highly inter-dependent region that straddles the border between western Massachusetts and northern Connecticut.

Figure 1- Knowledge Corridor

New manufacturing process technologies, the demand for new and innovative products, and the growing need for manufacturers to utilize sustainable business practices require the adoption of new approaches to doing business and achieving operational excellence. In addition, in order to remain competitive, particularly in light of the COVID-19 pandemic and its global impact, the industry must develop a workforce development plan to attract, professionally develop, and retain a sustainable pipeline of new employees, while simultaneously providing opportunities for their incumbent workforce to remain technologically relevant. The industry-led regional partnership comprised of advanced manufacturing companies, educational institutions, and state and regional entities continues to take a leadership role in positioning the companies to remain competitive in advanced design and manufacturing.

The availability of a well-educated and appropriately sized workforce is the companies' competitive advantage in today's ever changing and volatile global economy. Currently, however, the regional companies continue to experience acritical shortages of qualified employees at all levels, and prioritized the following occupations as most in demand. (Figure 2). This workforce reality is constraining their future growth and expansion.

Figure 2

The companies require on-going support in identifying and adopting new technologies appropriate to their business, optimizing their manufacturing processes, and in particular, developing short-term solutions and long-term strategies to address to their workforce needs and requirements.

The Findings and Recommendations in the **2022 Workforce Development and Technology Adoption Report** will be used by the regional partnership to continue to implement programs and activities that will strengthen the industry's competitiveness, create opportunities for market expansion, accelerate job creation and retention, and drive the continued economic development of the Region and the State.

OVERVIEW

The ***2022 Workforce Development and Technology Adoption Report*** is part of the on-going implementation of the Regional Planning strategies and goals codified in the **Pioneer Valley Labor Market Blueprint- 2018-2022,** produced by the MassHire Workforce Boards of Hampden, Franklin Hampshire Counties. The Report presents data, findings, and recommendations based on responses from fourteen (14) targeted advanced manufacturing companies in greater Pioneer Valley (Appendix-1) that completed the 2022 Workforce Development and Technology Adoption Survey (Appendix-2).

The company response rate to the 2022 Survey was significantly lower that in the previous five (5) biennial Surveys (2012-2020) and made it challenging to use the concrete workforce data to project future workforce needs and requirements across the broader Region 2 advanced manufacturing eco-system. The Survey was sent to forty eight (48) targeted companies with a response rate of 29%.

The 2022 Report is divided into the following five Sections:

1. **Market Segmentation and Business Trends**
2. **Workforce Needs**
3. **Manufacturing Operations**
4. **Technology/ Innovation Priorities**
5. **Education Initiatives**

The following Framework was used as a general guide to assess the current state of the broader regional advanced manufacturing sector.

The ***2022 Workforce Development and Technology Adoption Report*** provided an analysis of the industry's needs, challenges, and opportunities. It offered selected **Recommendations** for addressing those needs and challenges which include:

- Securing an adequately skilled and trained workforce in the near-term.
- Adopting new, innovative manufacturing processes and technologies.
- Creating a sustainable and predictable pipeline of new employees to respond to future workforce needs and surges in production demand.
- Increasing public awareness of careers in advanced manufacturing.

The ***2022 Workforce Development and Technology Adoption Report*** can be viewed on the web site of the MassHire Hampden County Workforce Board Inc. www. masshirehcwb.com/, MassHire Franklin Hampshire Workforce Board, at www.masshirefhwb.org and on the web site of the Western Massachusetts Chapter of the National Tooling and Machining Association at http://www.wmntma.org

EXECUTIVE SUMMARY

Advanced manufacturing is a priority industry in the Pioneer Valley Region of Massachusetts. The regional advanced manufacturing companies are primarily Job Shops and Contract Shops (Aka SMEs) that are part of a supply chain engaged in producing precision mechanical parts, components, and sub-assemblies utilizing high technology equipment, lean manufacturing, and world class technology development. The companies are conducting business in multiple markets with Aerospace, Commercial, Defense, and Power Generation being the strongest market segments for the regional companies**.**

In order to remain competitive and maintain strong customer-supplier relationships, the industry requires a sustainable pipeline of qualified new employees and a technologically relevant incumbent workforce. The availability of a well-educated workforce is the differentiator that gives the regional advanced manufacturing companies the competitive advantage to conduct business in today's global economy- an economy that continues to evolve as a result of the COVID-19 pandemic and certain geo-political factors. The highest priority need for both replacement and new production employees along the advanced manufacturing workforce pipeline is for CNC Machinists, Process Engineers, Machinists and Quality Control Inspectors.

Over the next three years, based on the demand numbers from **just the thirteen Job Shops and Contract Shops** that responded to the 2022 survey, and using a conservative employee multiplier, the broader advanced manufacturing companies in the region will need **343** new production employees. The regional educational institutions and workforce training programs will graduate an estimated **444** students from their manufacturing programs during the same three-year time period. The regional partnership must develop a strategic workforce development plan that will implement training programs and creative program delivery models to respond to this critical Supply Gap across the Pioneer Valley.

The SMEs need help in identifying new technologies appropriate to their business, optimizing their manufacturing processes, and in particular developing short-term interventions and solutions, and long-term strategies to respond to their workforce needs at all levels.

Process innovation and new software technology adoption, in particular around Enterprise Resource Planning, is critical to the SMEs ability to conduct business and remain competitive within their existing supply chains. Identifying and adopting affordable and compatible software packages will allow the smaller companies to remain competitive and move to the next growth stage. New technology adoption is a business imperative and will strengthen the industry's competitiveness, create opportunities for market expansion, and accelerate the economic development of the Region and in the State.

The regional partnership must work more closely with the region's educational institutions to provide support and assistance to ensure that curriculum content is aligned with industry needs, employability readiness skills are embedded into the curriculum, and career awareness initiatives that educate parents on the viability of advanced manufacturing as a personally and financially rewarding career pathway for their student are accelerated.

The Regional partnership, led by the MassHire Workforce Boards of Hampden, and Franklin Hampshire Counties, must continue to work with the regional sector companies to obtain appropriate federal, state, and private funding to conduct workforce training programs, develop and implement technology innovation initiatives, and increase the capacity of the regional education institutions to continue to be effective and valued partners in the work ahead.

Regional Advanced Manufacturing Industry
2022 Workforce Development and Technology Adoption Survey

N= 14 Companies

Section I- Market Segmentation and Business Trends

1. **Which category best describes your business relationship to your customer?**

Customer Business Relationship	Number of Companies		
	2022	2020	2018
Job Shop -Independent Company-Primarily Short Run and Other Non-Repeatable Jobs	13 (64%)	22 (55%)	23 (56%)
Contract Shop- Independent Company- Primarily Contracts for Repeating Part Numbers	4 (29%)	16 (40%)	13 (31%)
Captive Company-Part of a Larger Company	1 (7%)	1 (2.5%)	5 (12%)
Equipment Distributor		1 (2.5%)	-

Findings

- The majority of the regional advanced manufacturing companies responding to the 2022 survey characterized their customer business relationship as either a **Job Shop (64%)** or a **Contract Shop (29%),** as defined above. A small number of companies indicated their customer business relationship was split between Job Shops and Contract Shops.

- One manufacturing company characterized their firm as a **Captive Company** with a different structure and business model.

2. **Which of the Following Best Describes Your Company's Ownership?** ***NEW***

Ownership	No. of Companies
Family Owned	13
Minority Owned	
Veteran Owned	(1)
Woman Owned	(2)
None of These	1

Note: Ownership in ( ) Included in *Family Owned* Total

Findings

- The vast majority of the companies indicated that they are **Family Owned** enterprises .Three of those companies also indicated they were either **Veteran** or **Woman** owned.

3. **How Many Work Shifts Per Day Did Your Company Typically Run In 2021?** **NO. OF SHIFTS: _____** ***NEW***

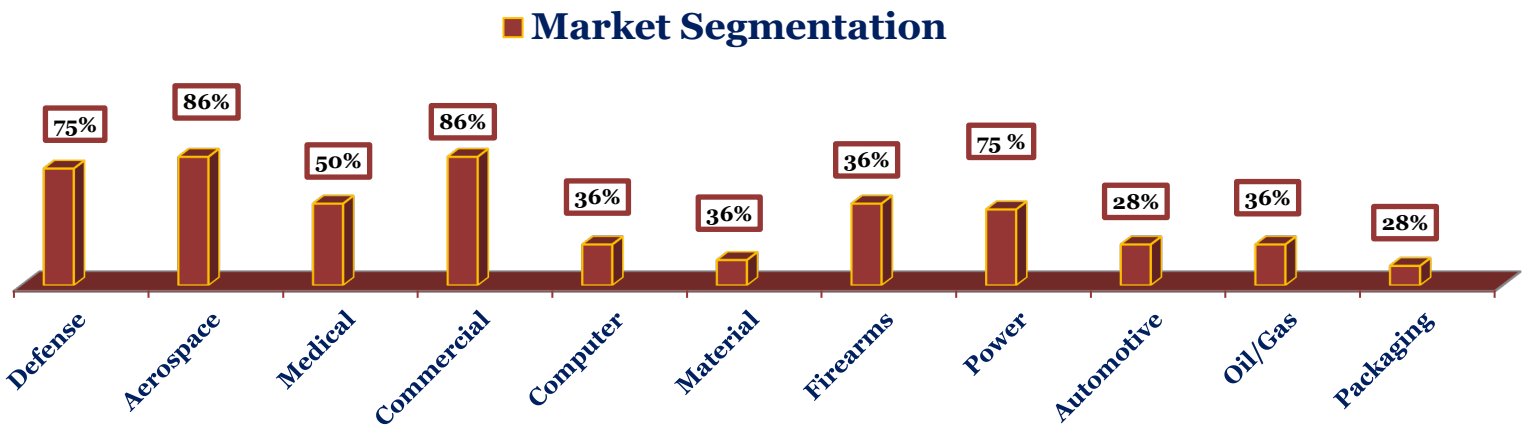
Shifts	No. of Companies
1	6
1.5	2
2	5
3	1

Findings

- The Regional advanced manufacturing companies operated on multiple work schedules. **43%** indicated that they conduct business only on one shift, and **36%** indicated that their production schedule is structured to operate on two shifts.

4. **Please indicate the principal markets in which you conduct your manufacturing business.**

Markets	No. of Responses	Market Ranking						Markets	No. of Responses	Market Ranking					
		2022	2020	2018	2016	2014	2012			2022	2020	2018	2016	2014	2012
Defense	9	3	2	2	3	3	3	Firearms	5	7	7	6	4	5	10
Aerospace	12	1	1	1	1	1	1	Power Generation	9	4	5	5	5	6	5
Medical Device	7	5	4	4	6	4	4	Automotive	4	9	9	7	7	8	-
Commercial	12	2	3	3	2	1	2	Oil/Gas Field	5	6	6	8	8	9	-
Computer/Telecom.	5	8	10	11	9	7	6	Packaging	4	10	11	8	5	11	7
Material Handling	3	11	8	10	11	10	9	Cosmetics	-	-	12	-	-	-	-



Findings

- The regional advanced manufacturing companies conducted business in multiple market segments with **Aerospace (86%)** and **Commercial (86%)** the two most active market segments. Aerospace continued to be a critical market for the regional company's book of business.
- The presence of **(75%)** of the regional companies in **Defense** related markets was consistent with the historically high percentage of companies that have previously indicated a concentrated presence in this market segmentation.
- The presence of seven (7) companies **(50%)** in the **Medical Device** market was consistent with the percentage of companies that indicated a presence in that market segmentation in 2020 and 2018.
- The **Power Generation** market showed a significant presence **(75%)** in the regions market segmentation in the 2022 survey, and continued to be an important market for selected regional manufacturers. The 2022 percentage is a significant increase from 40% in the 2020 survey.
- The percentage of regional companies engaged in the **Firearms (36%)** market continued to decline.

Recommendations
The regional partnership must continue to collaborate with state agencies to develop a closer working relationship between the state's OEMs and the regions Job Shops and Contract Shops to ensure greater presence in existing supply chains.

- The Aerospace, Commercial and Defense markets continue to support and drive business in the region, and their continued national and global presence is critical to the continued growth and expansion of the regional Job Shops and Contract Shops.

5. **Which Quality Certifications Does Your Company Presently Hold? Please Check All That Apply.** ***NEW***

Quality Certifications	No. of Companies
NADCAP	2
ISO 9001:2015	10
ISO 13485:2016	0
AS9100D	7
(OTHER) FAA Repair Station	1

Findings

- **71%** of the regional companies have the **ISO 9001:2015** Quality Certification, and **50%** of the companies have **AS9100D** Certification.

6. **Do you have plans for growing or expanding your company over the next three (3) years? If so, please indicate (√) if the growth plan involves any of the following actions:**

Actions	Number of Responses					
	2022	2020	2018	2016	2014	2012
Introducing New Products	4	15	20	16	15	15
Introducing or Integrating New Technologies	14	19	26	22	21	22
Building Relocation/Expansion	8	11	16	15	9	17
Achieving Greater Cost Efficiencies	14	21	34	26	16	21
Accessing New Markets	7	25	25	20	23	26
(OTHER)	-	1	3	3	6	-

Findings

- Implementing methods and processes to **Achieve Greater Cost Efficiencies** continued to be a critical part of the strategic plan of the regional companies.

- **100%** of the companies indicated that they are laser-focused on **Introducing or Integrating New Technologies** into their manufacturing operations.

- The number of regional companies **(8)** that indicated their growth strategy moving forward included **Building Relocation/Expansion** was up signicantly as a percentage of respondents from the 2020 survey, and is indicative of regional companies' confidence in future business trends and economic activity.

Recommendations
- The partnership should continue to encourage the regional companies to work closely with regional and State-wide economic development entities and industry associations to develop opportunities for the companies to engage in coordinated networking and matchmaking events that will position them to access business in new and emerging markets. - The regional partnership should continue to coordinate activities to develop resources that will support SME's participation at national trade shows that will position them to access business in new market segments.

7. If you are planning to purchase a new machine tool in 2018/2019, please indicate your reason for considering this capital equipment investment. Please list Top Two Priorities:

Reason	Priority			
	2022	2020	2018	2016
Increase Machine/Equipment Capacity	1	1	1	1
Machine/ Process Flexibility	2	2	2	
New Machines to Reduce Costs				2
Tighter Quality Standards				

Findings

- The companies continued to view **Increasing Machine/Equipment Capacity** as their major reason for considering the purchase of new machine tools in 2020/2021.

- Achieving **Machine/Process Flexibility** was clearly the second priority for the companies, and indicated their continued need to remain agile and positioned to respond to a myriad of job orders that require process control and reliability throughout the manufacturing cycle.

8. **Please compare the general TRENDS that you are seeing in your manufacturing operations in January 2020 compared to January 2019 AND July 2019**

Indicator	January 2022 Compared to January 2021				January 2022 Compared to July 2021			
New Orders	☐ Growing	**11**	☐Contracting	**3**	☐ Growing	**10**	☐Contracting	**1**
Production	☐ Growing	**11**	☐ Contracting	**2**	☐ Growing	**10**	☐Contracting	**2**
Backlog	☐ Growing	**10**	☐ Contracting	**3**	☐ Growing	**9**	☐Contracting	**1**
Material Prices	☐Increasing	**14**	☐Decreasing	**-**	☐Increasing	**14**	☐Decreasing	**-**
Supplier Deliveries	☐ Lengthening	**14**	☐ Shortening	**-**	☐ Lengthening	**14**	☐ Shortening	**-**
Future Business Expectations	☐ Improving	**12**	☐ Declining	**1**	☐ Improving	**11**	☐ Declining	**-**

+

Findings

- On a year to year basis, the regional companies manufacturing operation **Indicators** were **Trending Positively.** For a number of companies, **Supplier Deliveries Lengthened** during CY 2021 and into CY 2022. Longer delivery times indicate that suppliers may have capacity and/or access challenges that may impact their ability to meet the on-time demands of their customers.

- January 2022 manufacturing operations **Indicators** in comparison to July 2021 continued strong and suggest positive trends throughout the balance of 2022. Current supply chain pressures, rising materials costs, and the lingering international climate caused, in part, by the Russian invasion of Ukraine will need to be monitored carefully, and may impact selected Indicators moving into the second half of CY 2022 and the first six months of CY 2023.

- **Future Business Expectations** remain positive.

Section II- Workforce Needs

9. Total number of employees in your company_____. Total number of production employees in your company.

Findings

Customer Business Relationship	Number of Companies		
	2022	**2020**	**2018**
Job Shop	**9**	**22**	**23**
Contract Shop	**4**	**16**	**13**
Captive Company	**1**	**1**	**5**
Equipment Distributor	**-**	**1**	**-**

- The majority of the regional advanced manufacturing companies responding to the 2022 Survey characterized their customer business relationship as either a **Job Shop** or a **Contract Shop** is defined in **No.1** above.

Year	2022	2020	2018	2016	2014
Total Companies	14	40	41	40	38
*Total Employees	1,176 [576]	2,302	2,353	2,291	2,006

NOTE: * The Captive Company identified in Q- 1 has 600 employees. The other 13 companies, (Job Shops and Contract Shops-Aka SME), represent a total of 576 employees. The data presented and analyzed in the Tables in Q. 9-11 will be displayed as follows: TOTAL - [SME].

Year	2022	2020	2018	2016	2014
Total Companies	14	40	41	40	38
Total Employees	1,176 [576]	2,302	2,353	2,291	2,006
Total Production Employees	783 [383]	1,649	1,577	1,486	1,095
% of Production Employees to Total Employees	67% [67%]	72%	67%	65%	55%

- There are **1,176 [576] TOTAL** employees in the fourteen (14) advanced manufacturing companies that responded to the 2022 Workforce Development and Technology Adaption Survey. This employment level, although from a small sample of companies, is significant and indicates the continued importance of the advanced manufacturing industry to the economic vitality of the region.

- Of the **1,176 Total Employees,** there are **783 Production Employees (67%)** directly involved in the manufacturing process on the plant floor. This compares to a Production Employee level of **1,649 (72%)** in the 2020 survey from a larger number of companies. The **percentage** of production workers is down from the 2020 survey but in line with findings from the 2018 and 2016 Surveys.

- The percentage of Production Employees in either data scenario is exactly the same at **67%.**

10. Number of Production employees retiring in the next three (3) years whose positions will need to be replaced.

Year	2022	2020	2018	2016	2014
Total Companies	14	40	41	40	38
Total Production Employees	783 [383]	1,649	1,577	1,486	1,095
Total Production Employees Retiring/Replaced	126-[51]	136	142	92	110
% of Production Employees Retiring	16%- [13%]	8.2%	9.0%	6.2%	10.0%

Findings

- A total of **126 [51] Production Employees, whose positions will need to be replaced,** will be retiring in the next three (3) years- an average of **42 retirements** a year. In the 2020 survey, a total of 136 employees from a much larger sample were retiring for an average of 45 retirements/replacements a year.

- The **126 [51]** planned production employee retirements /replacements represent **16%- [13%]** of the total production employees currently working in the 14 companies. This is a significant percentage increase from the **8.2%** planned retirements from the 2020 survey.

- In analyzing each of the 14 company's data, it appears that the number of retirements whose positions need to be replaced is **slowing. It is difficult from the sample size to see with clarity if this is a factor isolated to the 14 companies or a proxy for a trend among the companies in the region.**

Recommendation
Production employee retirement projections in the advanced manufacturing industry during the next three years will require companies to utilize all available networking and recruitment resources and strategies in order to identify the appropriate talent to replace these veteran technicians.

11. Number of NEW Production employees you project hiring over the next three (3) years.

Year	2022	2020	2018	2016	2014
Total Companies	14	40	41	40	38
Total Current Production Employees	783 [383]	1,649	1,577	1,486	1,095
Total NEW Production Employees to be Hired	199 [74]	261	370	320	212
% of NEW Production Employees to Current Production Employees	25.4% [19.3%]	15.8%	23.5%	21.5%	19.4%

Findings

- The regional companies reported that **199 [74] New Production Employees** need to be hired through December 31, 2024. This projected hiring level represents **25.4% [19.3%]** of the total current production employee levels. This is a significant percentage increase from the **15.8%** planned hiring of new production employees detailed in the 2020 survey.

- In analyzing each of the 14 companies, it appears that the projected level of hiring of new Production Employees over the next three years is **consistent with the total projected hiring level of 25.4% [19.3%]. It is difficult from the sample size to see with clarity if this is a factor isolated to the 14 companies or a proxy for a trend among the companies across the region.**

- The following table summarizes the **Workforce Indicators** combining the impact of planned Retirements of Production employees whose positions must be replaced, with the projected NEW Production Employee hiring demands indicated by the 14 companies.

Workforce Indicators	TOTAL				
	2022	2020	2018	2016	2014
Total Employees	1,176 [576]	2,302	2,353	2,291	2,006
Production Employees	783 [383]	1,649	1,577	1,486	1,095
Production Retirement Replacements	126 [51]	136	142	92	110
New Production Hires	199 [74]	261	370	320	212
TOTAL	325 [125]	397	512	412	322

SUMMARY FINDING

- Combining the projected **126 [51]** Replacement Production employee positions and the need for **199 [74]** NEW Productions employees creates a regional industry need for **325 [125] new** production employees in just the 14 manufacturing companies responding to the 2022 survey. Isolating the SME [125] hiring projections, and comparing that data with the 2020 hiring projections of 397 (40 companies), the **average number of New Production Hires for each company is Nine (9).**

- Projecting this to the broader advanced manufacturing industry in the Pioneer Valley Region based on **just the SME [125]** hiring projections, and using the historically conservative employee multiplier of 2.74, the demand side for production employees will be **343** employees during the three-year period.

- The Advanced Manufacturing Technology Program in the eight vocational technical/comprehensive/collaborative high schools (232) in the Pioneer Valley Region, the Associate Degree and Certificate programs in the Mechanical Engineering Technology program at Springfield Technical Community College (90), and the Manufacturing Training programs being sponsored by the MassHire Workforce Boards (122), based on current enrollment data, will graduate **444** students/individuals during the same three-year time period.

Recommendations

- The regional partnership must continue to engage the WMNTMA and its member companies, and other regional advanced manufacturing companies, education/training institutions, and other interested partners in the development of a **long range** strategic plan that addresses regional workforce development needs.
- **The regional advanced manufacturing partnership must continue to identify predictable funding streams that will scale-up existing workforce development programs, including Registered Apprenticeship programs, to respond to this persistent Supply Gap issue**.

12. Based on your responses to No. 8, please PRIORITIZE the number of REPLACEMENT and NEW employees in each of the Job Classifications in which you anticipate hiring in the next three (3) years.

Job Classifications	Replacement Priority						NEW Priority					
	2022	2020	2018	2016	2014	2012	2022	2020	2018	2016	2014	2012
Machinist	5	2	2	2	2	3	3	3	3	4	4	3
Tool Maker	4	4	5	6	5	6	8	9	6	9	8	6
General Machine Operator	12	9	8	7	7	4	7	6	7	3	7	4
CNC Machinist	1	1	1	1	1	1	1	1	1	2	1	1
CNC Operator	9	10	6	3	6	5	4	4	4	1	3	2
Process Engineer	2	5	7	5	3	7	2	7	8	5	6	8
CNC Programmer	7	7	4	9	8	10	5	5	5	7	5	7
QC Inspector	6	3	3	4	4	2	6	2	2	8	2	5
CAD/CAM Technician	10	12	10	10	9	8	10	11	9	10	10	10
Engineer	3	6	9	8	10	9	9	8	10	6	9	9
Software Technician	8	11	11	11	11	11	11	10	11	11	11	11
Other: Estimator	11	8	-	-	-	-	-	-	-	-	-	-

- The highest priority need for both replacement and new production workers continued to be for **CNC Machinists**. This demand has not changed from the previous year's surveys, and indicated that identifying qualified applicants with the requisite skills for this priority job classification will continue to be a high priority and a challenge for the regional companies.

- The demand for **Process Engineers** was an emerging high priority in both the Replacement and New Employee categories. Identifying qualified individuals with the requisite skills and experience to fill this job classification is be high priority, but a difficult challenge.

- The need for all purpose **Machinists** remained a consistent and high priority especially in the Replacement category and was directly tied to the retirement of experienced machinists. Similar to CNC Machinists, identifying qualified applicants with the requisite skills and experience to fill this job classification is a high priority, but a difficult challenge.

- Finding qualified **Quality Control Inspectors** for both Replacement **and** New Production employees remained a constant need for the regional companies, and reflected the value-added work that companies are performing for their customers.

- The need for **CNC Operators** remained a consistent and high priority both for replacement and particularly for companies hiring **New Production** employees. Identifying qualified applicants with the requisite skills to fill this job classification will require on-going collaborative efforts by the partnership to conduct training programs focused in this occupational classification.

Recommendations

- As experienced production operators approach retirement, companies must maintain a commitment to implementing comprehensive continuous improvement programs for their incumbent workers at all levels along the employment continuum.
- The regional partnership must accelerate efforts to identify flexible and sustainable funding to develop workforce development and training interventions which will prepare unemployed/underemployed individuals with the competencies required to fill critical, hard to fill positions.

13. Using the Wage Scale below, please indicate the average Hourly Wage Range for the following positions by entering the Wage Code next to each position for both Experienced and NEW employees.

Wage Code	Hourly Wage Range
A	Under $17.00
B	$17.01-$20.00
C	$20.01-$24.00
D	$24.01-$28.00
E	$28.01- ↑

Job Category	Experienced Wage Code					NEW Pipeline Wage Code				
	2022	2020	2018	2016	2014	2022	2020	2018	2016	2014
Machinist	D	E	D	D	D	D	C	C	C	C
Tool Maker	E	E	D	D	D	D	C	D	C	C
General Machine Operator	C	C	C	C	C	B	B	B	B	B
CNC Machinist	E	E	D	D	D	D	C	C	C	C
CNC Operator	C	C	C	C	C	C	C	C	C	C
Electro-Mechanical Technician	E	D	-	-	-	E	C	-	-	--
Process Engineer	E	E	E	E	E	D	D	D	D	D
CNC Programmer	E	E	E	E	E	D	D	D	D	D
QC Inspector	D	D	D	D	D	C	C	C	C	C

CAD/CAM Technician	E	E	D	E	D		D	D	C	D	C
Software Technician	E	E	E	D	E		E	D	C	C	B
Mech.Engineer	E	E	E	E	E		E	D	D	D	D

Findings

- **Experienced** production employees working in the high demand job classifications referenced above were compensated in the **$24.01-$28.00** ↑ per hour wage range. The 2022 hourly **wage ranges** in almost all Job Categories are unchanged from 2020.

- New production **CNC Operators** were compensated in the lower range $**17.01-$20.00** hourly wage range. This is in line with findings from previous years' surveys.

- The wages and fringe benefits in the regional advanced manufacturing industry are significantly higher than those found in other regional priority industries. The wage scale, benefit package, together with the continuous improvement/training opportunities available to employees, should be attracting more individuals to the profession.

14. Please indicate which of the following employment benefits, practices, and programs you offer to your full time employees.

Benefits, Practices, Programs	Number of Responses					
	2022	2020	2018	2016	2014	2012
Paid Medical Benefits	14	31	35	38	29	39
Profit/Revenue Sharing Plan	8	17	13	19	15	17
Bonus Plan	10	22	24	28	20	22
Annual Review and Raise Program	12	25	31	37	30	33
Formal Employee Training Program	10	16	26	23	17	23
Education/Training Reimbursement	10	20	24	28	18	29
Leadership Development	8	13	13	8	14	19
Apprenticeship Program	2	1	13	-	-	-
401-K	14	30	32	5	-	-
Employee Ownership Option	1	1	2	-	-	-

Findings

- **100%** of the companies offered **Paid Medical Benefits** to their employees. This percentage was an increase from the **89%** in the 2018 survey.

- **100%** of the companies offered a **401-K Plan** to their employees. This percentage was an increase from the **86%** in the 2020 survey.

- A significant number of the regional companies institutionalized an **Annual Review and Raise** program to reward and retain their incumbent workforce.

- **71%** of the companies offered their employees a **Bonus Plans** as a way to reward employee performance, retain talent, and incentivize their employees to continue to implement a company-wide culture of quality and operational excellence.

- The regional companies were committed to continuous improvement with **71%** of the companies offering **Education/Training Reimbursement** for their incumbent workers. This was consistent with the percentage of companies who offered this benefit in 2018.

- A commitment to company-specific **Employee Training Programs** to ensure that their employees have the technical competencies to respond to new technologies declined significantly from the previous two surveys. A company-wide commitment to training and continuous improvement is one of the key differentiators that will sustain their growth trajectory in a changing business climate.

1. **Leadership Development** was not identified as an established practice among the majority of regional companies, however a significant percentage of the responding companies indicated varying levels of commitment to this practice. Leadership development requires top-down management commitment and failure to develop strategies on this issue could have future long-term implications at the management levels of some of the regional companies.

15. Approximately how many hours of formal training did your Production Employees receive in 2021? NO. OF HOURS.

Number of Responses			Average Training Hours		
2022	2020	2018	2022	2020	2018
14	23	12	20	50	160

Findings

- A significantly higher percentage of companies indicated that they provide formal training to their production employees with an **Average of 20 Training Hours** during the pandemic year of 2021**.** Several companies had formal training that exceeded the average of 20 hours.

16. Please identify the factors/characteristics that you consider in hiring Production employees. Please list in Priority Order 1-8.

Hiring Factors/Characteristics	Experienced							NEW Pipeline					
	Priority							Priority					
	2022	2020	2018	2016	2014	2012		2022	2020	2018	2016	2014	2012
Technical Skills and Competencies	2	2	2	2	1	1		3	3	3	3	3	3
Interest in Learning and Self-Improvement	4	3	4	3	3	3		2	2	2	2	2	2
Attitude and Motivation	1	1	1	1	2	2		1	1	1	1	1	1
Related Experience in Manufacturing	3	4	3	4	4	4		4	4	4	4	4	4
Education/Training Beyond High School	6	5	6	6	6	7		5	6	5	5	5	7
Associates Degree in Manufacturing Related Field	7	7	7	7	7	-		7	7	7	7	7	-
Nationally Recognized Credential	8	8	8	8	8	-		8	8	8	8	8	-
Work Shift Flexibility	5	6	5	5	5	5		6	5	6	6	6	6

Findings

Experienced Production Employees

- **Attitude and Motivation** continued to be the leading factor/characteristic that influences the hiring process for both Experienced and New Pipeline employees as companies aggressively compete for talent in today's tight labor market.
- The regional companies continued to value an applicant's current **Technical Skills and Competencies** as a determining factor in hiring experienced applicants for production positions.
- **Interest in Learning and Self-Improvement** continued as a top priority for the regional companies, particularly in the hiring of new employees.
- **Related Experience in Manufacturing** and familiarity with the business and culture of manufacturing shortens employee on-boarding time and initial start-up training, and is important to company owners and production supervisors looking to sustain work and product flow on the production floor.
- **Formal Post-High School Education**, including attaining an **Associate's Degree in a Manufacturing Related Field,** and/or attaining a **Nationally Recognized Credential**, have remained unchanged, and are still not major factors in companies hiring decisions.

New Pipeline Employees

- **Attitude and Motivation** and **Interest in Learning and Self-Improvement** continued to be the most significant factors in hiring new pipeline employees.

- The **Technical Skills and Competencies** of new applicants for production positions continued to be highly valued by the companies and indicates, in a shrinking pool of applicants, the continuing value of applicants who have either some prior work experience in a general manufacturing setting, or have been involved in industry-related manufacturing training programs.

- **Formal post-high school education** continued as a minor factor in the hiring decision for new production employees. Going forward however, innovation and new technology may cause companies to reassess the factor of post-high school education in hiring new employees.

17 .Which of the following competencies/attributes would you like New Production Employees to possess? Please list Top 3 Competencies/Attributes in Priority Order.

Competencies/Attributes	Priority					
	2022	2020	2018	2016	2014	2012
Basic Employability/Job Readiness Skills	2	1	1	2	1	1
Mechanical Aptitude	1	2	2	1	2	2
Hands-On Machining Skills		3	3	3	3	3
Reading/Writing/ Verbal Communication						
Mathematics Skills						
Read and Interpret Blueprints	3					

- **Mechanical Aptitude**, although sometimes difficult to ascertain during the interview and selection process, was the key attribute that the regional companies would like new production employees to possess.

- **Basic Employability/Job Readiness Skills** continued to be a significant attribute that companies would like new production employees to possess. Good attendance and punctuality patterns, the ability to self-start, accept constructive suggestions in a positive manner, and maintain a positive attitude are important traits that employers are seeking in new employees.

- **Reading and Interpreting Blueprints** emerged in this year's survey findings as an important competency in the hiring process for new employees. Companies understand the need to provide technical support to new employees and are committed to providing new workers with opportunities for continuous improvement and skills enhancement.

Recommendations
Basic Employability/Job Readiness Skills should be embedded into the curriculum in all manufacturing training programs at the vocational technical high schools and community colleges. Programs/courses in manufacturing technology must continue to emphasize basic skills development with a strong emphasis on hands-on instruction in the operation of computerized numerically controlled (CNC) machine tools. The REVISED State approved Advanced Manufacturing Technology Framework must continue to guide technical instruction to ensure consistency in teaching the basic technical competencies.

18. Please identify the sources that have been most successful for your company in the recruitment and hiring of both Experienced and New pipeline production employees. Please Prioritize the Top 3 Sources.

Source	Experienced							New Pipeline					
		Priority						Priority					
	2022	2020	2018	2016	2014	2012		2022	2020	2018	2016	2014	2012
Private Employment or Recruiting Agencies	3	3	3										
Vocational High Schools/High Schools								1	3	2	1	1	2
MassHire One Stop Career Centers													
Internet/Social Media	1	1	2	2	2	3		2	1	3	3		
Community Colleges													
Newspaper Advertisements				3	3	2						3	3
Career and Technology Fairs													
Employee Referrals	2	2	1	1	1	1		3	2	1	2	2	1
Industry Networking Events													
County House of Corrections-Re-Entry Programs													
AE/English Language Literacy Programs													

Findings

- The **Internet/Social Media** continued to be the primary recruiting source for companies looking to hire **Experienced** employees, and is also an important tool for sourcing new employees.

- **Employee Referrals** continued to be a highly successful source for recruiting and hiring both experienced employees and identifying new production applicants.

- **Private Employment or Recruiting Agencies** have continued to be an important recruitment source for **Experienced** employees.

- Companies that have developed working relationships with the **Vocational Technical High Schools** continued to have success in using the schools as a source to recruit **New Production** employees. Several survey companies serve as **Cooperative Education** sites for students and retain many of the students following graduation.

- The Regions **One Stop Career Centers and Community Colleges** continued to be underutilized by the regional advanced manufacturing companies for recruiting either experienced or new production workers.

Recommendations
The regional partnership must continue to facilitate connectivity between the regional advanced manufacturing companies and the MassHire One Stop Career Centers to discuss ways to include the Centers as a more integral partner in the outreach and recruitment process. Regional companies must accelerate their involvement in Cooperative Education/ Internship programs that have demonstrated value as a recruitment method for attracting and retaining entry level production employees.

19. Does your company use the following social media?

Social Media	Number of Responses		
	2022	2020	2018
Facebook	8	21	16
Twitter	2	4	8
LinkedIn	9	21	24
Instagram	3	6	7
Snapchat *NEW*	0		
YouTube *NEW*	4		
Do Not Presently Use Social Media	2	4	7

Findings

- **LinkedIn and Facebook** are used by approximately **60%** of the regional companies and are important tools in their overall business strategy going forward.

- **Twitter and Instagram** usage both declined from the 2020 survey and are not used for professional use by many of the companies.

Section III. Manufacturing Operations

20. Please indicate which of the following Improvement Methodologies you regularly use in your manufacturing operations.

Improvement Methodologies	Number of Responses					
	2022	2020	2018	2016	2014	2012
Continuous Improvement Program	12	26	29	32	31	33
Benchmarking	10	24	29	32	29	32
Cellular Manufacturing	3	10	14	14	12	9
5S Workplace Organization	6	18	19	25	22	17
Kaizen Events	5	8	9	-	-	-
Just-in-Time Material Flow	1	11	12	18	11	20
Value Stream Mapping	4	9	11	18	12	10
Total Quality Management	2	10	13	-	-	-
Kanban and Pull Systems	5	7	11	14	13	-

Findings

- The regional cluster companies use a myriad of improvement methodologies in their manufacturing operations. Over 70% of the companies indicated they have a **Continuous Improvement Program** in place at their company, and view Benchmarking as an integral part of their manufacturing operations.

- The percentage of companies using **Kaizen Events** and **Kanban and Pull Systems** as improvement methodologies remained consistent from findings in the 2020 survey.

21. Please indicate which of the following Machining Strategies you regularly use in your manufacturing operations.

Machining Strategies	Number of Responses				
	2022	2020	2018	2016	2014
Five Axis Machining (Full Contouring)	4	16	12	21	18
Four Axis Machining (Full Contouring)	8	20	20	-	-
High Speed Machining	8	21	20	27	22
Lights-Out Machining	8	12	12	23	13
Composite Machining	2	7	9	6	N/A

Hard Turning	**3**	**17**	**16**	**19**	**14**
Hard Milling	**5**	**18**	**14**	**16**	**15**
Prototyping	**6**	**17**	**19**	**22**	**17**
Other: Grinding	**1**	**1**			

Findings

- **High Speed Machining** continued as a machining strategy that was regularly used by a significant number of the regional companies in their production process.
- The percentage of companies using **Lights Out Machining** as a machining strategy was constant from the previous year's surveys.
- The number of companies indicating that **Four Axis Machining (Full Contouring)** as one of the machining strategies used as a part of their manufacturing operations remains consistent. There was a slight decrease in the percentage of companies using **Five Axis Machining (Full Contouring).**
- **Hard Milling and Turning** was consistently used by the regional companies, with the incidence of company use holding steady throughout the four survey cycles.
- The regional companies (**42%)** continued to include **Prototyping** as both a service and a strategy in their relationship with their customers and believe that the service is an important strategy for generating new work moving forward.

22. Which Types Of Inspection Equipment Does Your Company Use? Please Check All That Apply. ***NEW***

Inspection Equipment	No. of Companies	Inspection Equipment	No. of Companies
CMM in Quality Department	**11**	**Laser Trackers**	**4**
CMM on Shop Floor	**5**	**On-Machine Probes**	**9**
Microscopes	**5**	**Optical Comparators**	**11**
Other: (Please Specify)			

Findings

- **78%** of the regional companies use **CMM** in their **Quality Departments** as part of their total quality assurance package.
- The use of **Optical Comparators** was a widely held practice and is used by most of the responding companies.

- A high percentage (**64%**) of companies used **On-Machine Probes** as part of their quality delivery programming.

23. Please indicate which of the following Supply Chain Practices part of your manufacturing operations are.

Supply Chain Practices	Number of Responses				
	2022	2020	2018	2016	2014
Collaboration Design with Customers (DFM)	8	14	20	23	20
Just-In-Time Deliveries	6	17	17	25	21
Access to Customers Forecasts	4	18	21	18	18
Customer Satisfaction Surveys	10	21	29	29	27
Certification of Major Suppliers	9	20	22	23	25
None of These	-	-	2	5	2

Findings

- **Customer Satisfaction Surveys** continued to be the most acknowledged supply chain practice that is imbedded in the manufacturing operations of the regional companies.
- **Certification of Major Suppliers** continued to be a significant supply chain practice of the companies, and is widely used by both small and medium sized advanced manufacturing companies.
- A larger percentage of companies from the 2020 survey indicated that they regularly use **Collaboration Design with Customers (DFM)** as a standard practice.

24. Do you use **Robots** to perform part loading/unloading for any of your machine tools?

Robots	Number of Responses		
	2022	2020	2018
YES	2	6	6
NO	12	26	29
Total	14	32	35

Finding

- **86%** of the company's responding to the question indicated that they do **NOT** use Robots to perform part loading/unloading for their machine tools. This trend is unchanged from the past two years industry surveys.

25. Please indicate if your company has 3D additive manufacturing/ part printing capability?

3D Additive Manufacturing	Number of Responses		
	2022	2020	2018
YES	2	9	7
NO	12	23	26
Total	14	32	33

Finding

- **86%** of the companies responding to the question indicating that they do **NOT** presently have 3D additive manufacturing/part printing capability. The **14%** of the companies that do utilize this technology were some of the larger companies within the SME cohort.

26. If you answered **YES**, please indicate what you use your **3D** additive manufacturing/ part printing capability to produce. (Please check ALL that apply)

3D Additive Manufacturing	Use		
	2022	2020	2018
Look and Feel Prototypes To Validate Designs	2	5	4
Functional Prototypes To Test Parts Before Production	1	6	2
Tooling And Fixturing Used Internally	2	5	5
Tooling And Fixturing Produced for Customers *NEW*	-	-	-
Short-Run Initial Production	-	1	2
Full Production Of End-Use Parts	2	3	2

Finding

- The regional companies indicating they have **3D** additive manufacturing/ part printing capability are using the technology as indicated above and remains unchanged from the 2020 survey.

27. If you do not presently have 3D additive manufacturing/part printing capability, would your company make use of prototyping facilities, including 3D printing and other tools, if they were available in the region?

3D Additive Manufacturing	Number of Responses				
	2022	2020	2018	2016	2014
YES	7	12	9	18	24
NO	6	14	16	12	9
Total	13	26	25	30	33

Findings

- The percentage of companies indicating that they would **NOT** make use of Prototyping Facilities, including 3D printing and other tools, if they were available in the region was slightly higher than the past two surveys, but continues to indicate only marginal interest in this technology as it impacts their current manufacturing operations.

- The positive future adoption from **50%** of the companies responding to the question indicated the need to continue to engage the companies in discussion moving forward.

28. Please identify the following emerging manufacturing technologies that might be relevant to your company or that you want to learn more about:

Interest in Emerging Manufacturing Technologies	Yes					No					Need More Information				
	2022	2020	2018	2016	2014	2022	2020	2018	2016	2014	2022	2020	2018	2016	2014
Sensing, Measurement and Process Control	3	17	15	22	16	2	5	2	5	1	1		2	3	6
Mt Connect	3	6	7	6	4	2	10	4	7	1	2	1	5	4	8
New Materials Design, Synthesis and Processing	3	3	3	10	6	2	13	8	8	6	2	1	2	1	5
Digital Manufacturing Technologies And Product Lifecycle Management (PLM)	1	6	4	9	5	2	10	4	5	5	3	1	5	5	7
Sustainable Manufacturing	3	7	8	10	13	2	9	2	6	2	2	1	6	3	4
Metal Additive Manufacturing	4	9	16	14	14	2	9	4	5	1	1		1	4	3
Industrial Robotics	3	13	13	20	13	1	4	1	5	3	1		3	4	2
Advanced Forming and Joining Technologies	3	3	3	5	5	2	9	6	6	6	3		3	5	1

Findings

- **Sensing, Measurement and Process Control** continues to be a technology that is relevant to the companies**.**

- In comparison to responses from the 2020 survey, a significant number of companies, indicated that many of the technologies are NOT relevant to their current manufacturing operations.

29. Do you currently have a Machine Monitoring System in place for some or all of your machine tools?

Machine Monitoring System	Number of Responses		
	2022	2020	2018
YES	2	12	10
NO	9	17	17
Total	11	29	27

Findings

- Of the companies that responded to this survey question, there continued to be limited use of any type of a **Machine Monitoring System** in their manufacturing operations. This is consistent with comparable usage data from both the 2020 the 2018 surveys.

Section IV. Technology/Innovation Priorities

30. Please indicate the Enterprise Resource Planning (ERP) software that is presently being used by your company.

ERP Software Use	No. of Companies	Product Name
1. ERP Integrated Software Package	11	Alliance Epicor QAD E-2 Shop Tech IQMS Job Boss Global Shop
2. Job Shop Operation -Planning and Execution Package	11	Job Boss Epicor
3. Financial Software Adaptation	11	QuickBooks Job Boss
4. Manual And General Purpose Software	11	Excel, Office 365
5. Internally Developed/Proprietary System		N/A

a. If you use an integrated Enterprise Resource Planning software package, please provide the following assessment:

ERP Software Assessment	2022		2020		2018		2016		2014	
	YES	NO	YES	NO	YES	NO	Yes	No	Yes	No
Are You Satisfied With The ERP Software Product You Are Using?	13	0	20	1	25	2	25	11	19	6

Does The Implementation and Use of the S/W Require New Skills/Training for Employees?	**9**	**3**	**24**	**-**	**22**	**4**	**24**	**6**	**17**	**4**
Is the Investment In The ERP Software (Including the Implementation) Justifiable?	**12**	**0**	**25**	**-**	**21**	**3**	**24**	**7**	**23**	**1**
Does This ERP Software Tool Make Your Company More Competitive?	**10**	**1**	**24**	**-**	**20**	**3**	**22**	**11**	**22**	**3**

Findings

- The companies continued to use a wide range of **ERP Software** packages as part of their manufacturing operations, and there is clearly no one ERP Software package that is the standard among the regional SMEs.
- The SMEs were in a **50/50 ratio** of those using an integrated software package versus those companies using compartmentalized software to manage specific areas of their business.
- The companies used a wide variety of **Job Shop Operation-Planning and Execution** software packages as part of their manufacturing processes. **Job Boss** was the software most referenced.
- **QuickBooks** continued to be the preferred **Financial Software Adaptation** package used by the companies. The companies have a comfort level with QuickBooks and continued to use it as their preferred software.
- **Excel** continued to be the leading **Manual** and **General Purpose Software** being used by the regional companies.
- A significant percentage of the regional companies believed the **investment** in their respective ERP software (including the implementation) **was justified**, and a significantly number of the companies indicated that their chosen ERP software tool was **making their company more competitive.**
- The companies were **generally satisfied** with the ERP software products they are using and continued to identify software packages that were affordable, flexible, and easily adapted to their manufacturing processes.

31. Please indicate the CAD/CAM and Simulation Software that is presently being used by your company.

CAD/CAM/Simulation Software	No. of Companies	Product Name
1. Integrated CAD/CAM Package	**11**	**Solidworks** **Edge CAM** **Mastercam** **Esprit** **AutoCAD** **TekSoft**

CAD/CAM/Simulation Software	No. of Companies	Product Name
2. Product Lifecycle Management (PLM) (Integrated With Customers)	2	E-2
3. 3D CAD Vendor Supported System	1	Solidworks
4. 3D CAD Free System		
5. Modeling, Simulation/Verification Software	6	Vericut Siemens NX SolidWorks Espirit Autodesk
6. Programmable Automation Software	5	AutoCAD

a. **If you use an integrated CAD/CAM or PLM software package, please provide the following assessment:**

CAD/CAM or PLM Software Assessment	2022		2020		2018		2016		2014	
	YES	NO	Yes	No	Yes	No	Yes	No	Yes	No
Implemented CAD/CAM Or PLM to Satisfy Customer Requirements	4	5	15	10	15	7	16	11	12	11
Are You Satisfied With The Product You Are Using?	8	0	22	3	20	5	27	3	27	2
Does Your Software Vendor Provide Appropriate And Effective Support?	8	0	21	1	19	4	28	2	25	3
Does the Software Implementation Require New Skills/Training For Employees?	8	0	12	12	13	11	25	5	25	2
Is the Investment (Including the Implementation) Justifiable?	8	0	21	3	17	7	26	3	24	2
Do You Believe That This Tool Makes Your Company More Competitive?	8	0	19	6	17	8	28	1	27	1

Findings

- **Mastercam** was the preferred Integrated CAD/CAM and Simulation Software that companies are using in their manufacturing operations.
- The regional companies indicated that **Solidworks** was the 3D CAD Vendor Supported System they utilize in their business.
- The regional firms indicated that they using a variety of Modeling, Simulation/Verification Software packages in their manufacturing processes and operations.

Section V. Education Initiatives

32. Which of the following initiatives should the partnership focus on to assist the educational system in preparing students for careers in the advanced manufacturing industry? Please list Top 3 Initiatives in Priority Order.

Initiatives	Priority					
	2022	2020	2018	2016	2014	2012
Align Technical Curriculum with Industry Needs	1	1	1	1	1	1
Strengthen Employability Readiness Instruction for Students	2	2	2	2	2	2
Develop Paid/Unpaid Summer Employment Opportunities for Students at Manufacturing Companies						
Develop Paid Summer Professional Development for Vocational Teachers at Manufacturing Companies						
Increase Informational Programs/Activities for Counselors and Teachers						
Increase Career Awareness Programs /Events for Parents	3	3	3	3	3	3

Findings

- The regional partnership must continue to work with the educational institutions to provide supports and assistance to ensure that the program/course **Technical Curriculum** is **Aligned with Industry Needs.** This continued to be the top priority of the companies to ensure the availability of qualified new talent pipeline going forward.

- Strengthening the **Employability Readiness** of students was critical to the successful employment assimilation, retention, and career advancement of new employees. Instruction in this area must be embedded into the technical curriculum and be consistently reinforced with the students.

- Developing and implementing a comprehensive and coordinated plan to **Increase Career Awareness** programs/events for parents to educate them on the viability of advanced manufacturing as a personally and financially rewarding career pathway for their students must continue to be a top priority of the work of the regional partnership.

Recommendations
The partnership must continue to implement its strategic initiatives to assist the vocational technical high schools in preparing program graduates for careers in advanced manufacturing.
School budgets and staff allocation formulas should be weighted in support of technical program's that graduate and place students in related employment positions that meet documented regional labor market demand.

33. Please indicate which of the following workforce development initiatives your company is interested in becoming involved in to strengthen the regional advanced manufacturing industry.

Initiatives	Number of Responses					
	2022	2020	2018	2016	2014	2012
Speaking to Parent / Student Groups Regarding Careers in Advanced Manufacturing	10	19	20	21	23	21
Exhibiting at Education Career and Technology Fairs	7	17	14	16	15	16
Contributing Tooling/Material to Schools	9	21	18	21	19	20
Working with Instructors to Incorporate Industry Standards into Curriculum	9	20	19	18	15	16
Serving as Mentors/Advisors at Selected Schools	6	16	19	19	13	14
Instituting Company Sponsored Educational Scholarships	3	8	12	6	4	5
Hiring Vocational/Community College Teachers for Paid Summer Work	3	14	11	13	11	8
Encouraging Employees to Serve as Instructor's in Manufacturing Training Programs for Adults	4	5	-	-	-	-
Develop and Conduct Project-Based Learning Activities to Increase Awareness and Interest in Advanced Manufacturing Careers	1	5	-	-	-	-

Findings

- Companies continued to express their interest in **Working with Instructors** to ensure that the curriculum reflects current and future competencies that will facilitate new employee assimilation onto the factory floor.
- The regional companies continued to partner with selected schools to **Speak to Parent Organizations/Student Groups** regarding careers in advanced manufacturing. This initiative continued to be of significant interest to the regional companies.

Recommendations
The regional partnership must continue to provide technical support, mentoring support, work-based learning opportunities, and financial incentives to assist the regions educational institutions in preparing program graduates for careers in advanced manufacturing.
Program Advisory Committees at the regions vocational technical high schools must continue to identify creative ways to educate parents on the financial viability of a career pathway in advanced manufacturing.
Guidance counselors must continue to emphasize the educational and career employment pathways that are available for students in advanced manufacturing.

34. Please indicate if your company would be interested in providing the following career related activities/supports to students in the Advanced Manufacturing Technology Program at the technical high schools in the Pioneer Valley region.

Activities/Supports	Number of Responses					
	2022	2020	2018	2016	2014	2012
Job Shadowing	8	18	18	22	19	21
Cooperative Education Program	8	19	20	22	20	23
Unpaid School Year Internships	8	16	17	20	17	22
Paid Summer Employment	9	23	23	21	23	23
Part Time After- School/Saturday Employment	5	20	17	19	14	21

Findings

- The regional companies continued to support **Paid Sumer Employment** and **Part Time After-School/Saturday Employment** as good ways to build their future workforce, and continue to engage with the educational institutions to provide students with these learning opportunities.

- **Cooperative Education** was widely used by the regional companies to attract a pipeline of new entrants into their companies. Several companies and have long-standing relationships with the regional technical schools to ensure the viability of this educational option.

Recommendation
The partnership must continue to work with regional companies and the educational institutions to develop a coordinated process and set of protocols to develop student internship opportunities, identify paid summer employment and part-time after-school positions, and increase cooperative education placement agreements as a way of improving and accelerating the process of transitioning students to career employment positions in the industry following graduation.

35. Which of the following broad-based initiatives should be considered to strengthen advanced manufacturing as a critical industry sector in the Pioneer Valley Region and in the Commonwealth? Please list Top 3 Initiatives in Priority Order.

Initiatives	Priority					
	2022	2020	2018	2016	2014	2012
State-Wide Marketing Campaign to Promote the Advanced Manufacturing Industry	2	2	3	2	3	1
Development of a Coordinated Applicant Referral System						
Alignment of Educational/Training Infrastructure and Programs with Industry Needs	3	1	2	3	1	3
Expanded Continuous Improvement Programs for Incumbent Employees						
Programs to Increase School, Student, and Parent Awareness of Careers in Manufacturing	1	3	1	1	2	2
Access to Training Programs Including Registered Apprenticeships, Work Based Learning						

Findings

- Continuing programing and activities to increase **School, Student, and Parent Awareness** of careers in advanced manufacturing in order to change the perception of manufacturing, increase student enrollment and graduation rates, and strengthen the regional industry-education partnership continued to be one of the top three priority initiatives identified by the companies.

- Alignment of **Programs with Industry Needs and Requirements** emerged as the key priority for the companies moving forward, and attainment of this priority will require continued coordination and communication between the regional companies and the educational institutions both at the secondary and community college level.

- Implementing a **State-Wide Marketing Campaign** to promote advanced manufacturing as a priority industry in the Region continued to be a priority of the regional companies. The companies acknowledge the significant commitment of resources and time that the State has invested in promoting the industry across the commonwealth.

36. Please indicate which of the following organizations/sources has your company successfully used for the education/training of your production employees?

Organizations/Sources	Number of Responses					
	2022	2020	2018	2016	2014	2012
Internal Staff	12	26	30	22	29	35
External Consultants	11	16	19	10	16	16
Industry Associations/Organizations	7	13	16	12	17	18
MassHire Workforce Boards	4	12	23	20	23	14
Technical /Vocational High Schools	6	17	15	18	20	22
Community Colleges/Universities	4	14	16	15	14	15
MA Workforce Training Fund (WTF)	11	17	21	16	13	-
Online Training	9	9	8	7	7	9

Findings

- The regional companies have varied approaches to providing education/training to their production employees and see value in using a variety of education/training providers and delivery models contingent upon their specific business need.

- Using **Internal Staff to** provide education/training to their incumbent production employees continued to be the most widely used source for continuous improvement programming. This trend has remained constant from the findings in the previous surveys.

- Fewer companies viewed the **MassHire Workforce Boards/Career Centers** as a source for the up-skilling of the regional company's incumbent production employees.

- Regional companies continued to use the State's **Workforce Training Fund** as a practical and cost-effective way of professionally developing their incumbent employees to respond to innovation and new manufacturing processes that drive company growth and ultimately new job creation.

- The **technical/vocational high schools** and **community colleges** continue dto be critical partners for providing technical skills enhancement and college credit courses for the region's incumbent manufacturing employees.

Recommendation
The regional MassHire Workforce Boards must continue its role as intermediary and market sector manager to work with the broad regional advanced manufacturing industry to obtain appropriate federal, state, and private funding to conduct training programs and initiatives for incumbent production employees, front line managers and supervisors, and persons interested in starting a career in advanced manufacturing.

37. Which of the following technology areas should be more fully integrated into the curriculum in the Advanced Manufacturing Technology Programs at the vocational technical high schools? Please list Top 3 Areas in Priority Order.

Technology Areas	Priority						Technology Areas	Priority					
	2022	2020	2018	2016	2014	2012		2022	2020	2018	2016	2014	2012
CNC Set-Up and Operation	2	1	1	2	2	1	CAD Fundamentals						
Quality Inspection Techniques	3	3	2	3	3	3	3D Printing Basics						
Reading/Interpreting Operations Sheets/Blueprints	1	2	3	1	1	2	Basic Rapid Prototyping						
Basic CNC Programming							Solid Modeling						

Findings

- **Reading/Interpreting Operation Sheets/Blueprints** emerged as this year's priority technology area within the Advanced Manufacturing Technology curriculum with **83%** of the companies indicating the need to prepare program graduates with this basic competency.

- **CNC Set-Up and Operation** continued to be a critical technology area that the companies would like to see more fully integrated into the curriculum in the Advanced Manufacturing Technology Programs at the vocational technical high schools. There was an extremely strong focus by the Job Shops to accelerate this section of the MTT curriculum.

- **Quality Inspection Techniques** was viewed by a high percentage of the companies as essential to preparing students to perform basic quality inspection of parts and sub-assemblies of increasing complex geometry.

38. Which of the following technology areas should be more fully integrated into the curriculum in the manufacturing/engineering technology programs/courses at the community college level? Please list Top 3 Areas in Priority Order.

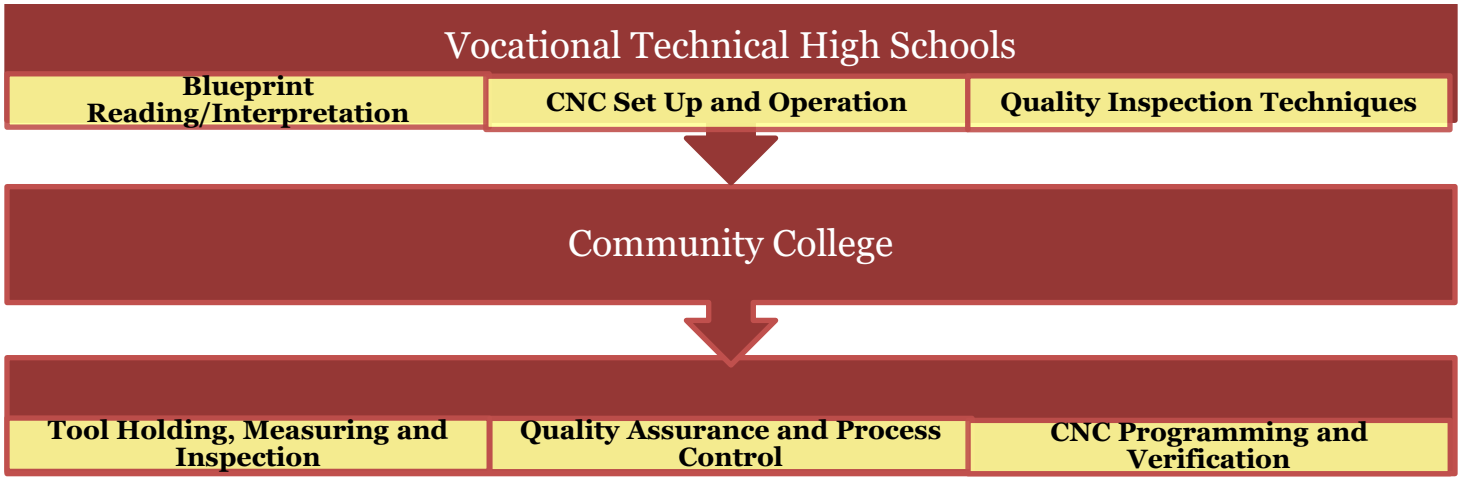
Technology Areas	Priority						Technology Areas	Priority					
	2022	2020	2018	2016	2014	2012		2022	2020	2018	2016	2014	2012
Multi-Axis Machining Techniques		3	3	2	2		Rapid Prototyping						
Tool Holding, Measuring and Inspection	1	1	1	1	3	3	CNC Programming and Verification	3				1	1
Using Solid Models in CAM Programs							Lean Manufacturing Theory and Implementation						
Quality Assurance and Process Control	2	2	2	3		2	Supply Chain Management Principles						
CAD Fundamentals							3D Printing						

Findings

- **Tool Holding, Measuring and Inspection Techniques** continued as the priority technology area that regional companies would like to see fully integrated into the manufacturing curriculum at the community college level.

- Similar to findings at the vocational technical high schools, strengthening the **Quality Assurance and Process Control** component of the community college's curriculum was of significant importance to the regional companies.

- **CNC Programming and Verification** reappeared as a top three priority technology area that companies would like to see community college manufacturing program graduates possess. Curriculum needs to be reviewed to make certain that this skill continues to be prioritized.



Recommendations
▪ The regional partnership must continue to provide on-going technical guidance and support to the educational institutions to ensure quality program development and implementation. Increasing student enrollment, providing internships and summer work opportunities, and increasing the graduation rate are critical to ensuring a workforce pipeline moving forward. ▪ The partnership working through the WMNTMA, and other regional manufacturing partnerships, must continue to seek out appropriate federal, state, and private funding to increase training programs and initiatives for unemployed/underemployed individuals to increase the supply of new employees and upskill incumbent workers.

August 2022

Appendix

Regional Advanced Manufacturing Industry
2022 Workforce Development and Technology Adoption Survey

Company: _____ **Contact Person:** _____ **E-Mail:** _____

Market Segmentation and Business Trends

1. Which Category Best Describes Your Business Relationship to Your Customer Base?

Customer Business Relationship	√
Job Shop (Independent company-primarily short run and other non-repeatable jobs)	
Contract Shop (Independent company- primarily contracts for repeating part numbers)	
Captive Company-(Part of a larger company)	

2. Which Of The Following Best Describes Your Company's Ownership? ***NEW***

Ownership	√
Family Owned	
Minority Owned	
Veteran Owned	
Woman Owned	
None of These	

3. How Many Work Shifts Per Day Did Your Company Typically Run In 2021? **NO. OF SHIFTS: _____** ***NEW***

4. Please Indicate The Principal Markets In Which You Conduct Your Manufacturing Business. Please Check All That Apply.

Markets	√	Markets	√
Defense/Military		Firearms	
Aerospace		Power Generation	
Medical		Automotive	
Commercial		Oil/Gas Field	
Electronics, Computers/Telecom.		Packaging	
Material Handling			
Other: (Please Specify)			

5. Which Quality Certifications Does Your Company Presently Hold? Please Check All That Apply. ***NEW***

Quality Certifications	√
NADCAP	
ISO 9001:2015	
ISO 13485:2016	
AS9100D	
(OTHER)	

6. Do You Have Plans For Growing Or Expanding Your Company Over The Next Three (3) Years? If So, Please Indicate (√) If The Growth Plans Involve Any Of The Following Actions:

Actions	√
Introducing New Products	
Introducing or Integrating New Technologies	
Building Relocation/Expansion	
Achieving Greater Cost Efficiencies	
Accessing New Markets	
(OTHER)	

7. If You Are Planning To Purchase A New Machine Tool In 2022/2023, Please Indicate Your Reason For Considering This Capital Equipment Investment. Please list Top Two Priorities:

Reason	Priority	Reason	Priority
Increase Machine/Equipment Capacity		New Machine to Reduce Costs	
Machine/ Process Flexibility		Tighter Quality Standards	

8. Please Compare The General TRENDS That You Are Seeing in Your Manufacturing Operations in January 2022 Compared To January 2021 AND July 2021

Indicator	January 2022 Compared to January 2021		January 2022 Compared to July 2021	
New Orders	☐ Growing	☐Contracting	☐ Growing	☐Contracting
Production	☐ Growing	☐ Contracting	☐ Growing	☐Contracting
Backlog	☐ Growing	☐ Contracting	☐ Growing	☐Contracting
Material Prices	☐Increasing	☐Decreasing	☐Increasing	☐Decreasing
Supplier Deliveries	☐ Lengthening	☐ Shortening	☐ Lengthening	☐ Shortening
Future Business Expectations	☐ Improving	☐ Declining	☐ Improving	☐ Declining

Workforce Needs

9. Total Number of Employees in Your Company_____ Total Number of PRODUCTION Employees in Your Company_____.

10. Number of Production Employees Retiring In The Next Three (3) Years Whose Positions Will Need To Be Replaced _____.

11. Number of NEW Production Employees You Project Hiring Over the Next Three (3) Years _____.

12. Based On Your Responses To No. 10 And 11 Above, Please Estimate The Number Of Replacement And NEW Employees In Each Of The Job Classifications In Which You Anticipate Hiring In The Next Three (3) Years.

Job Classification	Replacement		NEW
Machinist			
Tool Maker			
General Machine Operator			
CNC Machinist			
CNC Operator			
Process Engineer			
CNC Programmer			
QC Inspector			
CAD/CAM Technician			
Engineer			
Software Technician			
Other:(Please Specify)			

13. Using the Wage Scale below, please indicate your average Hourly Wage Range for the following positions by entering the Wage Code next to each position for both EXPERIENCED and NEW employees.

Wage Code	Hourly Wage Range
A	Under $17.00
B	$17.01-$20.00
C	$20.01-$24.00
D	$24.01-$28.00
E	$28.01- ↑

Job Classification	Experienced	Wage Code		NEW Hire	Wage Code
Machinist					
Tool Maker					
General Machine Operator					
CNC Machinist					
CNC Operator					
Electro-Mechanical Technician					
Process Engineer					
CNC Programmer					
QC Inspector					
CAD/CAM Technician					
Software Technician					
Mechanical Engineer					
Other: (Please Specify)					

14. Please indicate which of the following employment benefits, practices, and programs you offer to your full time employees.

Benefits, Practices, Programs	√
Paid Medical Benefits	
Profit/Revenue Sharing Plan	
Bonus Plan	
Annual Review and Raise Program	
Formal Employee Training Program	
Education/Training Reimbursement	
Leadership Development	
State Registered Apprenticeship Program	
401(k) Plan	
Employee Ownership Options	
Other: (Please Specify)	

15. How Many Hours of Formal Training Did <u>EACH</u> of Your Production Employees Average In 2021? NO. OF HOURS _____

16. Please Identify The Most Important Factors/Characteristics That You Consider In Hiring Production Employees. <u>Please List In Priority Order: 1-8.</u>

Hiring Factors/Characteristics	EXPERIENCED EMPLOYEES	Priority		NEW HIRES	Priority
Technical Skills and Competencies					
Interest in Learning and Self-Improvement					
Attitude and Motivation					
Related Experience in Manufacturing					
Education/Training Beyond High School					
Associates Degree in Manufacturing Related Field					
Nationally Recognized Credential (Ex. NIMS, MSSC)					
Work Shift Flexibility					

17. Which Of The Following Competencies/Attributes Would You Like New Production Employees To Possess? Please List Top 3 Competencies/Attributes In Priority Order.

Competencies/Attributes	Priority
Basic Employability/Job Readiness Skills	
Mechanical Aptitude	
Hands-On Machining Skills	
Reading/Writing/ Verbal Communication	
Mathematics Skills	
Read and Interpret Blueprints	
Other: (Please Specify)	

18. Please Identify The Sources That Have Been Most Successful For Your Company In Recruiting And Hiring Of Both Experienced And New Production Employees. Please Prioritize The Top 3 Sources.

Source	Experienced Priority		New Hires Priority
Private Employment or Recruiting Agencies			
Vocational High Schools/High Schools			
MassHire One Stop Career Centers			
Internet/Social Media			
Community Colleges			
Newspaper Advertisements			
Career and Technology Fairs			
Employee Referrals			
Industry Networking Events			
County Houses of Corrections -(Re-Entry Programs)			
ABE/English Language Literacy Programs			
Other: (Please Specify)			

19. Does Your Company Use The Following Social Media?

Social Media	√
Facebook	
Twitter	
LinkedIn	
Instagram	
Snapchat	
YouTube	
Do Not Presently Use Social Media	
Other: (Please Specify)	

Manufacturing Operations

20. Please Indicate Which Of The Following Improvement Methodologies You Regularly Use In Your Manufacturing Operations.

Improvement Methodologies	√
Continuous Improvement Program	
Benchmarking	
Cellular Manufacturing	
5S Workplace Organization	
Kaizen Events	
Just-in-Time Material Flow	
Six Sigma	
Value Stream Mapping	
Total Quality Management	
Kanban and Pull Systems	
Other: (Please Specify)	

21. Please Indicate Which Of The Following Machining Strategies You Regularly Use In Your Manufacturing Operations.

Machining Strategies	√
Five Axis Machining (Full Contouring)	
Four Axis Machining (Full Contouring)	
High Speed Machining	
Lights-Out Machining	
Composite Machining	
Hard Turning	
Hard Milling	
Prototyping	
Other: (Please Specify)	

22. Which Types Of Inspection Equipment Does Your Company Use? Please Check All That Apply. ***NEW***

Inspection Equipment	√	Inspection Equipment	√
CMM in Quality Department		**Laser Trackers**	
CMM on Shopfloor		**On-Machine Probes**	
Microscopes		**Optical Comparators**	
Other: (Please Specify)			

23. Please Indicate Which Of The Following Supply Chain Practices Are Part Of Your Manufacturing Operations.

Supply Chain Practices	√
Collaboration Design With Customers (DFM)	
Just-In-Time Deliveries To Customers	
Access To Customers Forecasts	
Customer Satisfaction Surveys	
Certification Of Major Suppliers	
None Of These	
Other: (Please Specify)	

24. Do You Use Robots To Perform Part Loading/Unloading For Any Of Your Machine Tools? ☐ YES ☐ NO.

25. Please indicate if your company has 3D additive manufacturing/part printing capability? ☐ YES ☐ NO.

26. If you answered YES, please indicate what you use your 3D additive manufacturing/ part printing capability to produce. (Please check ALL that apply)

3D Printing	Use
Look And Feel Protypes To Validate Designs	
Functional Protypes To Test Parts Before Production	
Tooling And Fixturing Used Internally	
Tooling And Fixturing Produced For Customers	
Short-Run Initial Production	
Full Production Of End-Use Parts	

27. If You Do Not Presently Have 3D Additive Manufacturing/ Part Printing Capability Would Your Company Make Use Of Protyping Facilities, Including 3D Printing And Other Tools, If They Were Available In The Region? ☐ YES ☐ NO

28. Please Identify The Following Emerging Manufacturing Technologies That Might Be Relevant To Your Company Or That You Want To Learn More About:

Interest in Emerging Manufacturing Technologies	Yes	No	Need More Information
Sensing, Measurement And Process Control			
Mt Connect			
New Materials Design, Synthesis And Processing			
Digital Manufacturing Technologies And Product Lifecycle Management (PLM)			
Sustainable Manufacturing			
Metal Additive Manufacturing			
Industrial Robotics			
Advanced Forming And Joining Technologies			
Other (Please Specify):			

29. Do You Currently Have A Machine Monitoring System In Place For Some Or All Of Your Machine Tools? ☐ YES ☐ NO.

Technology/Innovation Priorities

30. Please Indicate The Enterprise Resource Planning (ERP) Software That Is Presently Being Used By Your Company.

ERP Software Use	Product Name
1. ERP/MRP Integrated Software Package (E.G. Global Shop Solutions)	
2. Job Shop Operation -Planning And Execution Package (E.G. Job BOSS)	
3. Financial Software Adaptation (E.G. Quick Books)	
4. Manual And General Purpose Software Packages (E.G. Excel)	
5. Internally Developed/Proprietary System	
6. None Of The Above- Other (Please Specify)	

a. If You Use An Integrated Enterprise Resource Planning Software Package, Please Provide The Following Assessment:

ERP Software Assessment	Reason
Are You Satisfied With The ERP Software Product You Are Using?	
Does The Implementation And Use Of The Software Require New Skills/Training For Employees?	
Is The Investment In The ERP Software Including The Implementation And Maintenance Justifiable?	
Does The ERP Software Make Your Company More Competitive?	

31. Please Indicate The CAD/CAM And Simulation Software That Is Presently Being Used By Your Company.

CAD/CAM/Simulation Software	Product Name
1. Integrated CAD/CAM Package	
2. Product Lifecycle Management (PLM) (Integrated With Customers)	
3. 3D CAD Vendor Supported System	
4. 3D CAD Free System	

5. Modeling, Simulation/Verification Software	
6. Programmable Automation Software	
7. None Of These	
8. Other (Please Specify)	

a) If you use an integrated CAD/CAM or PLM software package, please provide the following assessment:

CAD/CAM or PLM Software Assessment	Yes	No
Implemented CAD/CAM Or PLM To Satisfy Customer Requirements		
Are You Satisfied With The Product You Are Using?		
Does Your Software Vendor Provide Appropriate And Effective Support?		
Does The Implementation And Use Of Software Require New Skills/Training For Employees?		
Is The Investment (Including The Implementation) Justifiable?		
Do You Believe That This Tool Makes Your Company More Competitive?		

Education Initiatives

32. Which Of The Following Initiatives Should The Partnership Focus On To Assist The Regional Educational Institutions In Preparing Students For Careers In The Advanced Manufacturing Industry? Please List Top 3 Initiatives In Priority Order.

Initiatives	Priority
Align Technical Curriculum with Industry Needs	
Strengthen Employability Readiness Instruction for Students	
Develop Paid/Unpaid Summer Employment Opportunities for Students at Manufacturing Companies	
Develop Paid Summer Professional Development Opportunities for Vocational Teachers at Manufacturing Companies	
Increase Informational Programs/Activities for Counselors and Teachers	
Increase Career Awareness Programs /Events for Parents	
Other: (Please Specify)	

33. Please Indicate Which Of The Following Workforce Development Initiatives Your Company Is Interested In Becoming Involved In To Strengthen The Regional Advanced Manufacturing Industry.

Initiatives	√
Speaking to Parent Organizations/ Student Groups Regarding Careers in Advanced Manufacturing	
Exhibiting at Education Career and Technology Fairs	
Contributing Tooling/Material to Schools	
Working with Instructors to Incorporate Industry Standards into Curriculum	
Serving as Mentors/Advisors at Selected Schools	
Instituting Company Sponsored Educational Scholarships	
Hiring Vocational/Community College Teachers for Paid Summer Work	
Encouraging Employees to Serve as Instructors in Manufacturing Training Programs for Adults	
Develop and Conduct Project-Based Learning Activities to Increase Awareness and Interest in Manufacturing Careers	

Other: (Please Specify)	

34. Please Indicate If Your Company Would Be Interested In Providing The Following Career Related Activities/Supports To Students In The Machine Tool Technology Program At The Technical High Schools In The Pioneer Valley Region.

Activities/Supports	√
Job Shadowing	
Cooperative Education Program	
Unpaid School Year Internships	
Paid Summer Employment	
Part Time After- School/Saturday Employment	

35. Which Of The Following Broad-Based Initiatives Should Be Considered To Strengthen Advanced Manufacturing As A Critical Industry Sector In The Pioneer Valley Region And In The Commonwealth? Please List Top 3 Initiatives In Priority Order.

Initiatives	Priority
State-Wide Marketing Campaign to Promote Advanced Manufacturing Industry	
Development of a Coordinated Applicant Referral System	
Continued Alignment of the Educational/Training Infrastructure and Programs with Industry Needs	
Expanded Professional Development/Continuous Improvement Programs for Incumbent Employees	
Programs to Increase School, Student, and Parent Awareness of Careers in Advanced Manufacturing	
Continued Access to Job Creation/Training Programs Including Registered Apprenticeships, Work-Based Learning Programs	
Other: (Please Specify)	

36. Please Indicate Which Of The Following Organizations/Sources Your Company Has Successfully Used For The Education/Training Of Your Production Employees?

Organizations/Sources	√
Internal Staff	
External Consultants	
Industry Associations/Organizations	
MassHire Workforce Boards	
Technical /Vocational High Schools	
Community Colleges/Universities	
MA Workforce Training Fund (WTF)	
Online Training	
Other: (Please Specify)	

37. Which Of The Following Technology Areas Should Be More Fully Integrated Into The Curriculum In The Machine Tool Technology Programs At The Vocational Technical High Schools? Please List Top 3 Areas In Priority Order.

Technology Areas	Priority	Areas	Priority
CNC Set-Up and Operation		CAD Fundamentals	
Quality Inspection Techniques		3D Printing Basics	
Reading/Interpreting Operations Sheets/Blueprints		Basic Rapid Prototyping	
Basic CNC Programming		Solid Modeling	
(OTHER)		(OTHER)	

38. Which Of The Following Technology Areas Should Be More Fully Integrated Into The Curriculum In The Manufacturing/ Engineering Technology Programs/Courses At The *Community College Level*? Please List Top 3 Areas In Priority Order.

Technology Areas	Priority	Areas	Priority
Multi-Axis Machining Techniques		Rapid Prototyping	
Tool Holding, Measuring and Inspection		CNC Programming and Verification	
Using Solid Models in CAM Programs		Lean Manufacturing Theory and Implementation	
Quality Assurance and Process Control		Supply Chain Management Principles	
CAD Fundamentals		3D Printing	
(OTHER)		(OTHER)	

Please Add Any Comments That Will Assist The Team In Its Workforce Development And Technology Adoption Work.

Thank You for Completing the *2022 Workforce Development and Technology Adoption Survey*.

January 2022

CONTACT INFORMATION

For information on the **2022 Workforce Development and Technology Adoption Report,** please contact David M. Cruise at 413-755-1362 or dcruise@masshirehcwb.com .

For information on the Massachusetts Executive Office of Housing and Economic Development, please visit their web site at http://www.mass.gov/hed/ Information on the Massachusetts Executive Office of Labor and Workforce Development can be found at http://www.mass.gov/lwd/ .

Information on the Western Massachusetts Chapter of the National Tooling and Machining Association can be found on their web site at http://www.wmntma.org/