

The Role of Middle Skill Jobs in Maine's Innovation Economy

A Case Study for Maine's Comprehensive Research and Development Evaluation 2011

A Report to the Maine Department of Economic and Community Development

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INTRODUCTION

When asked to envision someone working in an innovation-based job, most Mainers probably picture a computer geek or someone wearing a white lab coat. But this vision only captures a portion of reality. In fact, Maine's innovation-based sectors span an array of industries and support jobs of all types—from those requiring a Ph.D. to those that necessitate less extensive educational credentials, such as a certificate or limited post-secondary education. These latter positions, those requiring some post high school training or education but less than a four-year college degree, are known as middle skill jobs. They are the largest and least understood part of the employment landscape of the innovation economy in Maine and across the US. In the technology clusters, they are also the fastest growing segment in terms of job demand.

This report examines the role of middle skill jobs in driving Maine's innovation economy. It addresses several sets of issues. The report includes an introduction to the concept of middle skill jobs and a review of why these jobs matter— to individuals who fill them or hope to fill them, to Maine's technology and innovation-driven businesses, and to the overall health of the state economy. The report also assesses how Maine's businesses, government, and education stakeholders are doing in terms of grooming a new generation of middle skill workers to meet rising demands.

The picture is mixed. Maine is full of pockets of excellence, but the state lacks a coherent strategy and system for helping Mainers access the training and skills needed for these jobs. Meanwhile, collaboration between business and training providers has been, until quite recently, fairly weak. Moreover, key partners, especially the state's community colleges, are starved for resources. They continue to "do more with less," but this strategy is not sustainable over the long term.

Middle skill jobs are projected to grow and will continue to be the largest segment of Maine's economy for the foreseeable future. National and global economic pressures will push the skill levels needed for these jobs even higher. Therefore, Maine has a vested interest in ensuring the state's education and workforce programs are well connected to and supportive of industry needs in these areas. This report highlights those needs and provides direction toward developing policies and programs to support a healthy middle skill workforce.

SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS

Findings

- Middle skill jobs play an important role in Maine's economy and throughout innovation-based industries.
 - Over 30% of all jobs in the State of Maine can be classified as middle skill, with projected job growth, especially in STEM related areas¹, higher than the average job growth rate.
 - Many middle skill job opportunities in the coming years will be "replacement" job openings as skilled workers retire, and those replacement jobs will require a higher degree of technology skills along with problem-solving and project management skills.
 - Students, parents and guidance counselors at the middle and high school levels have inadequate information about career opportunities for middle skill jobs and, because of this, students are not prepared to pursue them.
- Incumbent worker training is perceived as the greatest need among both industry and community colleges to address the need for middle skill jobs. There is a severe lack of funds to keep our existing workers up-to-date on skills, placing the state in jeopardy of losing more jobs in the future.
- Community colleges are critical resources in providing middle skill job training. Demand for their services is increasing, but funding levels are not keeping pace. Schools are "doing more with less," but this approach is not sustainable over the long-term.
- There are low-cost opportunities for the state to play a role in helping industry and workers. Maine's education and workforce system, however, does not seem to be organized in a way to facilitate a coordinated and systemic flow of information about existing career opportunities and planned industry programs. This inhibits the scaling of successful programs and the ability to reach more rural regions of the state.

Recommendations

A complete list of recommendations can be found later in the report. Here we offer a brief discussion of the five most critical implementation steps Maine can undertake to create an effective system to support middle skill jobs.

- Increase funding and support for incumbent worker training. Since many new job opportunities will be replacement openings for people retiring or moving up in their career, state programs to support workforce training should include funds to fill both replacement jobs and new jobs.
- Ensure adequate funding for non-credit divisions of community colleges, especially in high-demand, technology-based programs. Enable a pool of the state's workforce or cluster funds to be available for industry education programs pursuing federal grants, using state funds for both initial match and ongoing capacity building.
- Enhance career awareness efforts, especially in middle and high school grades, targeting counselors and teachers as well as students. Scale successful industry-led career awareness programs by providing a more coordinated and central means by which industry groups access and engage schools.
- Improve connections among state funds for cluster and related industry efforts, especially innovation-based funding managed by MTI and those managed through workforce development

¹ STEM stands for "Science, Technology, Engineering, and Mathematics"

channels. This would help industry groups to develop more coordinated and scalable programs that are based on market demands rather than grant criteria.

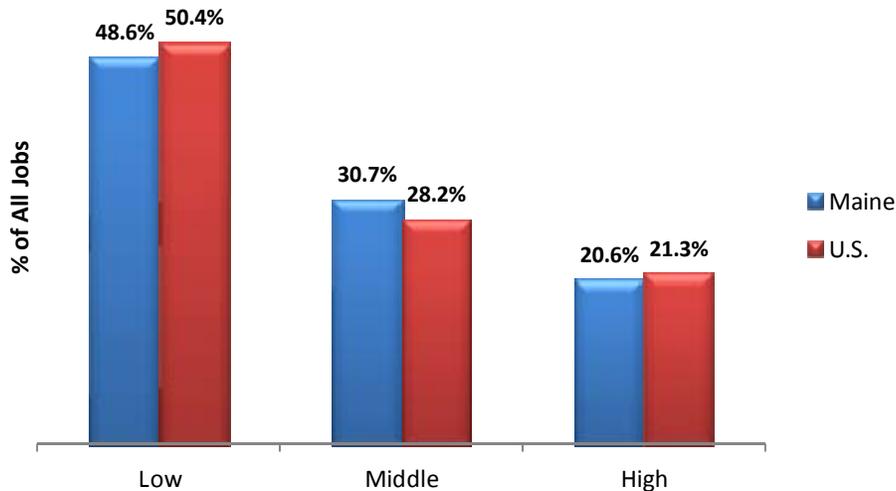
- Help increase industry experience for community college students by supporting development of flexible or non-traditional internships and related work experience programs with industry consortia.

THE IMPORTANCE OF MIDDLE SKILL JOBS

What are Middle Skill Jobs and Why Do They Matter?

Middle skill jobs are defined as those requiring some post-secondary education less than a Bachelor's degree; typically a certificate, associate's degree or an apprenticeship. Middle skill jobs are an important part of the economy in Maine and in most parts of the United States. In 2010, they represented 30.7 percent of all jobs in Maine and 28.2 percent of all jobs nationally (see Figure 1).

Figure 1: Jobs by Skill Level (2010)



Source: EMSI Complete Employment – 2011.3

Examples of middle skill jobs include:

- ***Cleantech employment*** (or “green” jobs) is projected to grow and will require installers as well as maintenance and repair personnel, most of which are middle skill jobs. Examples of these occupations include many found in the construction industry, such as:
 - Installation of renewable/alternative energy generating equipment (solar, wind)
 - Environmental Management Technicians (Lab Techs, field testing, etc.)
 - Power Line Technicians
 - Geological Technicians
 - HVAC (Heating, Ventilation and Air Conditioning) Technicians
- ***Health care and health services*** are projected to have higher than average job growth over the next decade with an array of middle skill jobs that include:
 - Lab Technicians
 - Radiological Technicians
 - Dental Hygienists
 - Diagnostic Medical Sonographers

- Respiratory Therapists
 - Radiologic Technologists
 - Occupational And Physical Therapy Assistants
 - Cardiovascular Technologists And Technicians
 - Licensed Practice/Vocational Nurses
 - Surgical Technologists
 - Forensic Science Technicians
- Information technology and telecommunications is projected to be slightly above average for job growth due to continued expansion in wireless applications and use of IT throughout other industries. Examples of middle skill jobs in this sector include:
 - Network Administrators and Network Control Analysts
 - Computer/Tech Support Specialists
 - Programmers
 - Help Desk Analysts
 - Telecommunication Installers
 - Professional and technical services are projected to remain steady with slight increases in sectors engaged in the replacement of critical transportation, water and energy infrastructure. Examples of these middle skill jobs include:
 - Lab and Testing Technicians
 - Electrical, Industrial, Mechanical and Civil Engineering Technicians
 - Aerospace Operations Technicians
 - Surveyor and Mapping Technicians
 - Drafting and Computer-aided Design (CAD) Technicians
 - The need for middle-skill jobs in manufacturing is projected to continue as workers retire and new production jobs require more technical knowledge and skills. These positions include:
 - Quality Assurance & Testing Specialists
 - Machine Installation & Industrial Machinery Mechanics
 - Electronics and Service Technicians
 - Manufacturing Engineering Technicians
 - Service Technicians

Why Do Middle Skill Jobs Matter To Individuals?

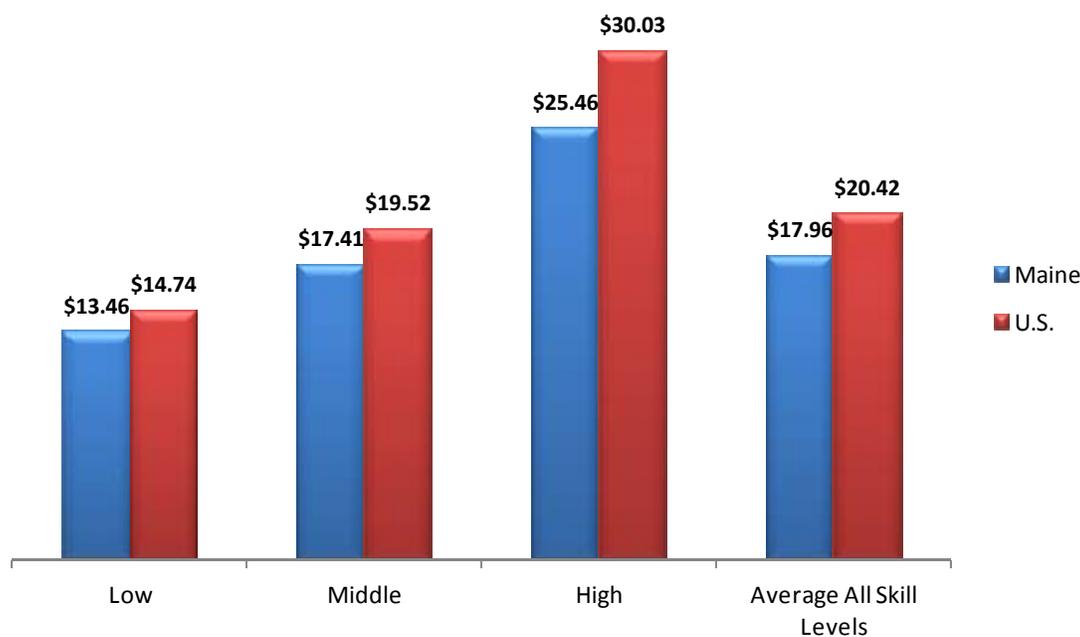
Middle skill jobs matter for many reasons. At the most basic level, they form a large portion of overall employment. More importantly, these jobs are accessible to a large swath of the population. At a time of high dropout rates (in both high school and college) and rising education costs, middle skill jobs offer an opportunity for people unable to complete a four-year college degree.²

² Harry Holzer, "Reviving the Labor Market with Middle Skill Jobs," Progressive Policy Institute Policy Memo, April 2010.

Middle skill jobs tend to offer reasonable pay and benefits. Thus, they are an attractive option to people without the resources or desire to attend a four-year college. One- or two-year programs, especially those with some flexibility in schedules, offer an option for increasing earnings potential and employment possibilities. And, by providing clear pathways to advancement, they help workers build careers that lead to further education and the resources to raise a family.

Data on Maine's occupational composition clearly shows that, not surprisingly, middle skill jobs provide better pay than lower skilled positions. In 2010, the median hourly earnings for middle skill jobs in Maine exceeded \$17 per hour, nearly 29% higher than average wages for low skilled employment (see Figure 2).

Figure 2: Median Hourly Earnings by Skill Level (2010)



Source: EMSI Complete Employment – 2011.3

Why Do Middle Skill Jobs Matter to Business and the Economy?

Middle skill jobs are key drivers of the national and the state economy. Economists project that the coming decades will see significant growth in demand for middle skill talent in most industry sectors. The Workforce Alliance notes that:

*"[...] the demand for workers to fill jobs in the middle of the labor market—those that require more than high-school, but less than a four-year degree—will likely remain quite robust relative to its supply, especially in key sectors of the economy. Accordingly, we see a need for increased U.S. investment in high-quality education and training in the middle of the skills range—not just for college graduates in science, technology, engineering, and math (STEM) fields."*³

Increasing demand for middle skill jobs is driven by a number of factors. The maturing of industries plays a role. When a firm is in start-up mode, its founders perform all of company's functions. In

³ Workforce Alliance, Skills2Compete Project, *America's Forgotten Middle-skill Jobs: Education and Training Requirements in the Next Decade and Beyond*

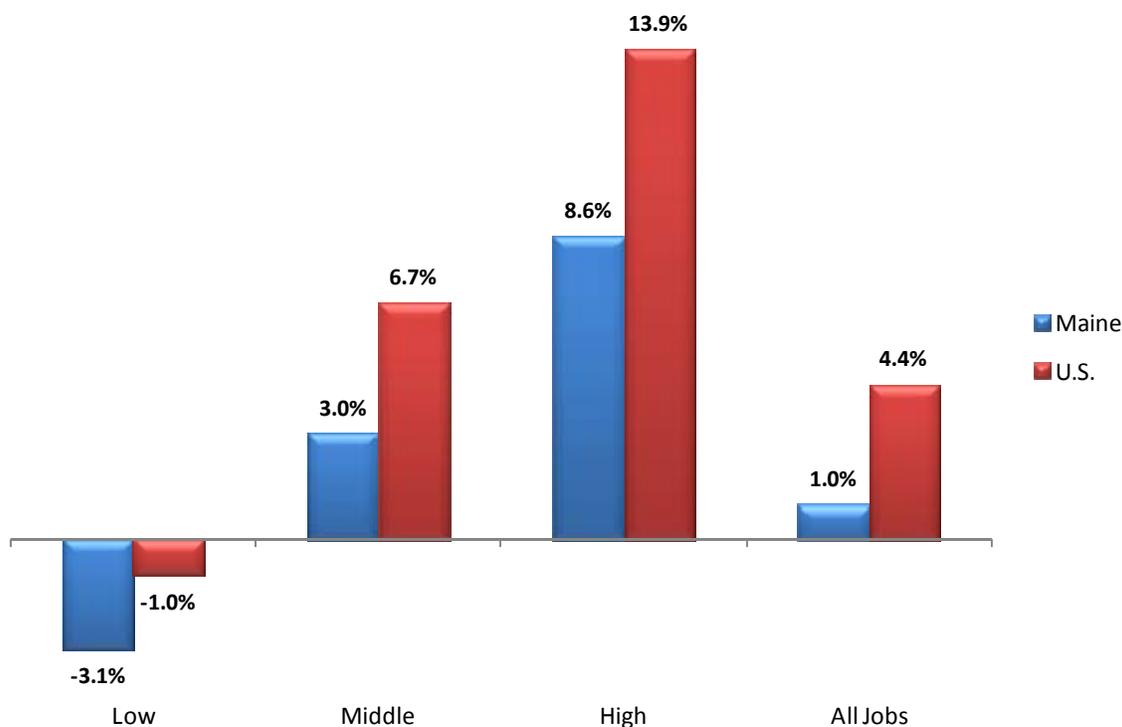
technology sectors, these founders tend to be highly educated. But, as the firm grows, it hires technicians and other support staff, i.e. middle skill jobs. As many of these companies mature, the ratio of middle skill jobs increases. Furthermore, many jobs in manufacturing and service industries are requiring more and more technological sophistication, increasing the required skill level of most jobs.

The maturing—or aging— of the workforce is an even more important driver of demand. In many key sectors, such as manufacturing, a whole host of middle skill jobs are held by workers nearing retirement age. Thus, the need for replacement workers may be even greater than the demand for new middle skill workers. For many regions, the ratio of replacement jobs to new jobs is two to three times higher in occupations such as electronic engineering technicians, HVAC installers, truck mechanics, and life science technicians. Even in rapidly growing healthcare occupations, there will be as many replacement jobs as new jobs.⁴

Employment trends in Maine echo these patterns. In fact, given that Maine’s population is older than the national average, the demand for middle skill replacement workers is more pronounced in Maine than elsewhere. In Maine, based on our analysis, it is projected that more than 78 percent of middle skill job openings in the next decade will be replacement jobs as opposed to new jobs.

This analysis suggests that, for the broader Maine economy, the relative skill level requirements for various job categories will hold relatively steady. However, a deeper dive into data on key occupational categories presents a more complicated picture. Between 2001 and 2010, middle skill jobs in Maine grew at a rate of three percent, far outpacing low skill jobs which declined by 3.1 percent. Meanwhile, Maine’s base of high skill jobs grew rapidly, rising by more than eight percent (see Figure 3).

Figure 3: Historical Percent Change in Jobs by Skill Level (2001-10)

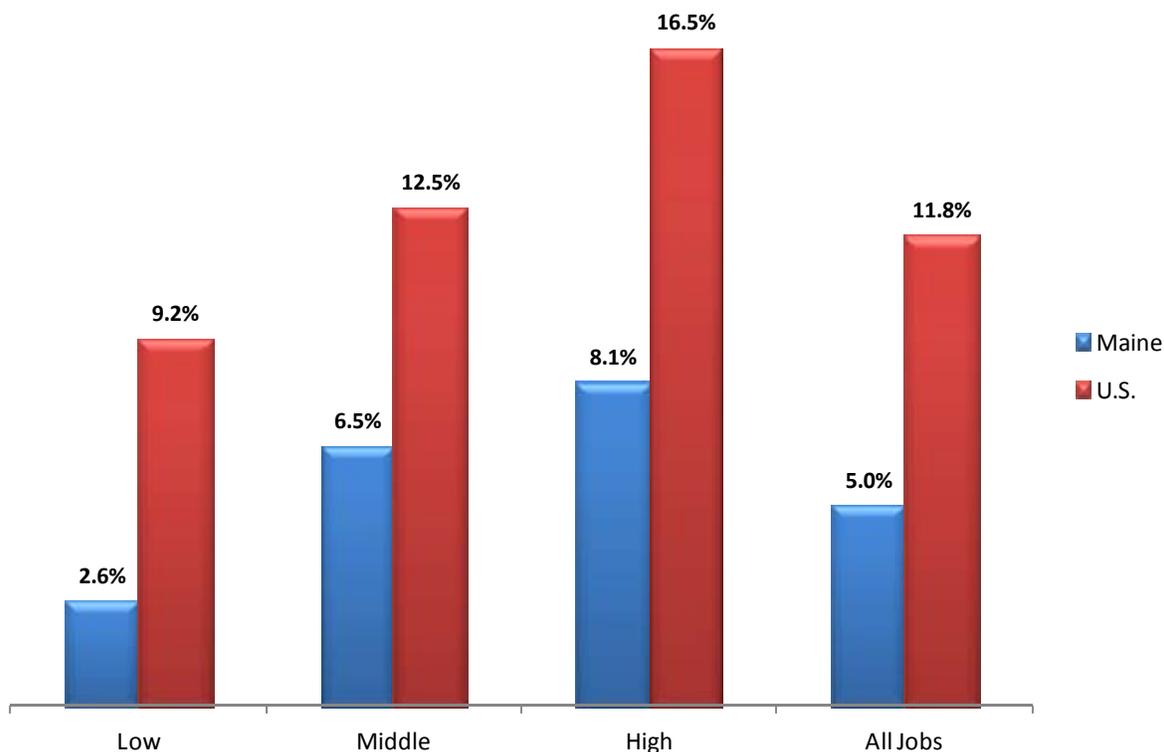


Source: EMSI Complete Employment – 2011.3

⁴ Consultant’s analysis of BLS data for twelve randomly selected middle-skilled jobs.

Future projections forecast robust demand for both middle and high skill jobs. Between 2010 and 2021, high skill jobs in Maine are expected to grow by 8.1 percent, while low skill employment will grow by only 2.6 percent. Meanwhile, middle skill job demand will jump by 6.5 percent (see Figure 4) with a projected increase of 15,749 jobs.

Figure 4: Projected Percent Change in Jobs by Skill Level (2010-21)



Source: EMSI Complete Employment – 2011.3

Why Do Middle Skill Jobs Matter for the Innovation Economy?

When looking at employment projections for Maine, strong demand for middle skill talent in STEM-related fields is one of the dominant trends. Across Maine and across the US, demand for middle skill jobs in the innovation economy is far outpacing overall demand. A July 2011 report from the US Department of Commerce found that:

- Between 2000 and 2010, non-STEM employment grew by 2.6 percent, while STEM employment grew three times faster at a rate of by 7.9 percent.
- Between 2008 and 2018, STEM employment growth will continue to outpace non-STEM employment growth (17% compared to 9.8%⁵).

Over the next decade, STEM occupations are slated to represent the sixth largest share of US job openings. For students leaving school in 2018, at least 8 million available jobs will require some STEM-

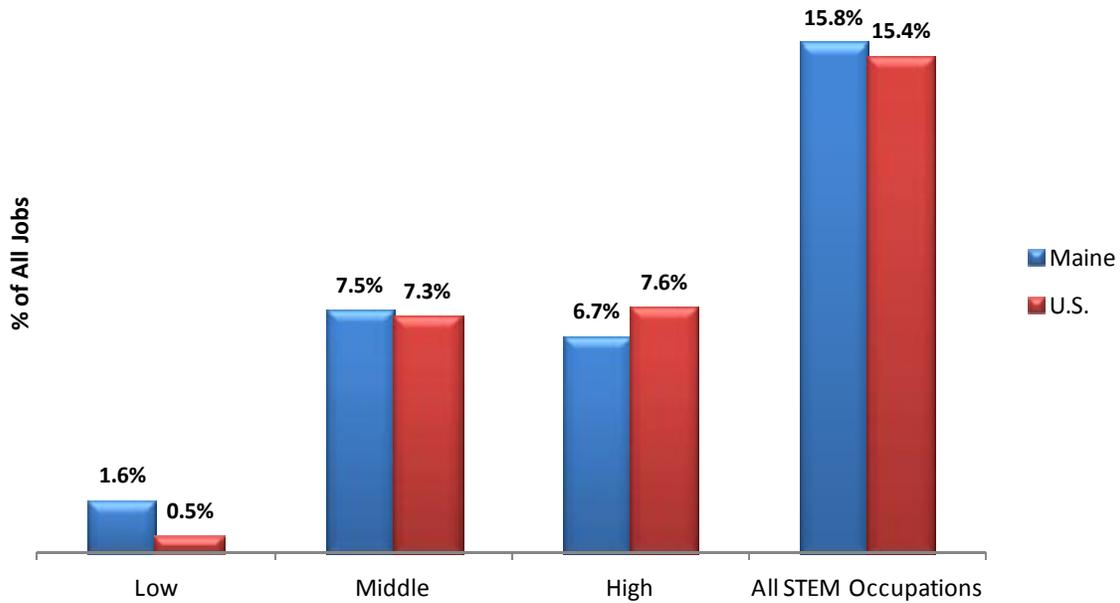
⁵ With recent job and economic growth projections, the percent growth is likely to be smaller than previous estimates, however the ratio between STEM and non-STEM employment is likely to remain constant.

⁶ Langdon, David, et. Al. US Department of Commerce, *STEM: Good Jobs Now and for the Future*, July 2011

focused training, with roughly half of those located in new or blended occupations and the other half of openings due to retiring workers.⁷

In 2010, 15.8 percent of all Maine occupations were in the STEM industries. Additionally, 47.3 percent of all STEM jobs (or, 7.5% of all jobs) in Maine were middle skill jobs, making it the largest skill category (see Figure 5).

Figure 5: Science, Technology, Engineering, and Mathematic (STEM) Jobs by Skill Level (2010)

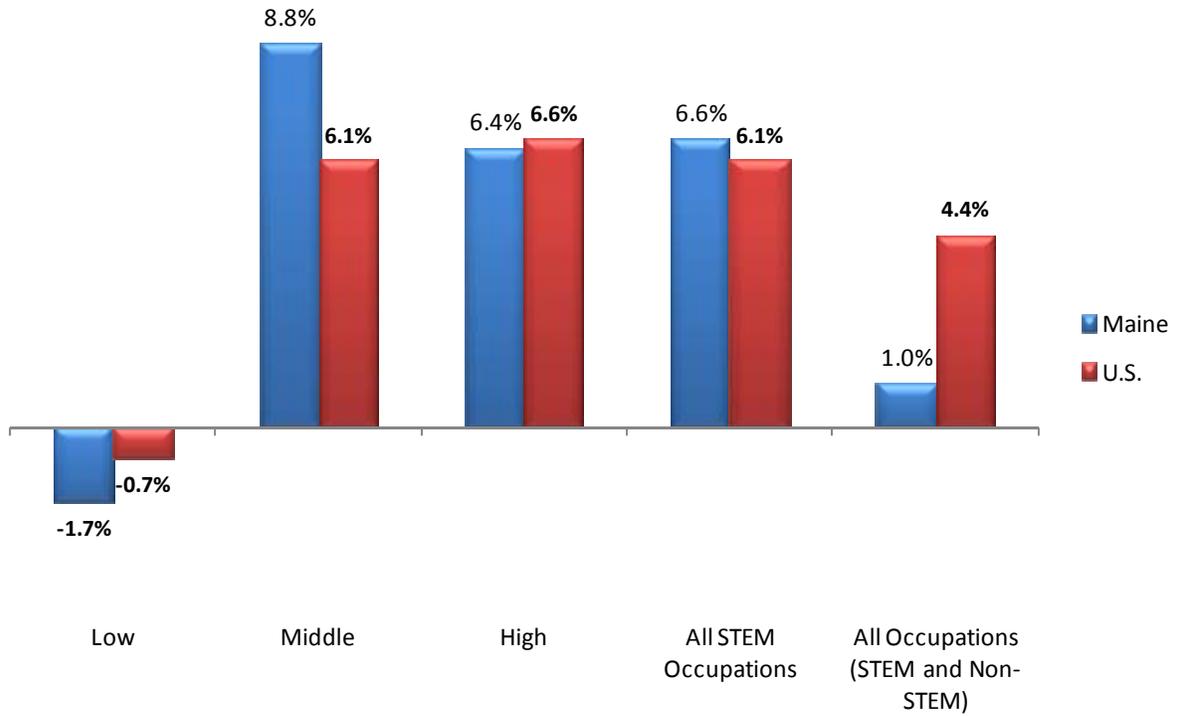


Source: EMSI Complete Employment – 2011.3

⁷ Carnevale, Anthony, Nicole Smith and Jeff Stohl, Help Wanted: Projections of Jobs and Education Requirements Through 2018” Center on Education and Workforce, Georgetown University 2010

Between 2001 and 2010, STEM occupations in Maine grew 6.6 percent compared to 1.0 percent for all occupations. In terms of skill levels, Middle skill STEM jobs grew the fastest in Maine during this period, at 8.8% (see Figure 6).

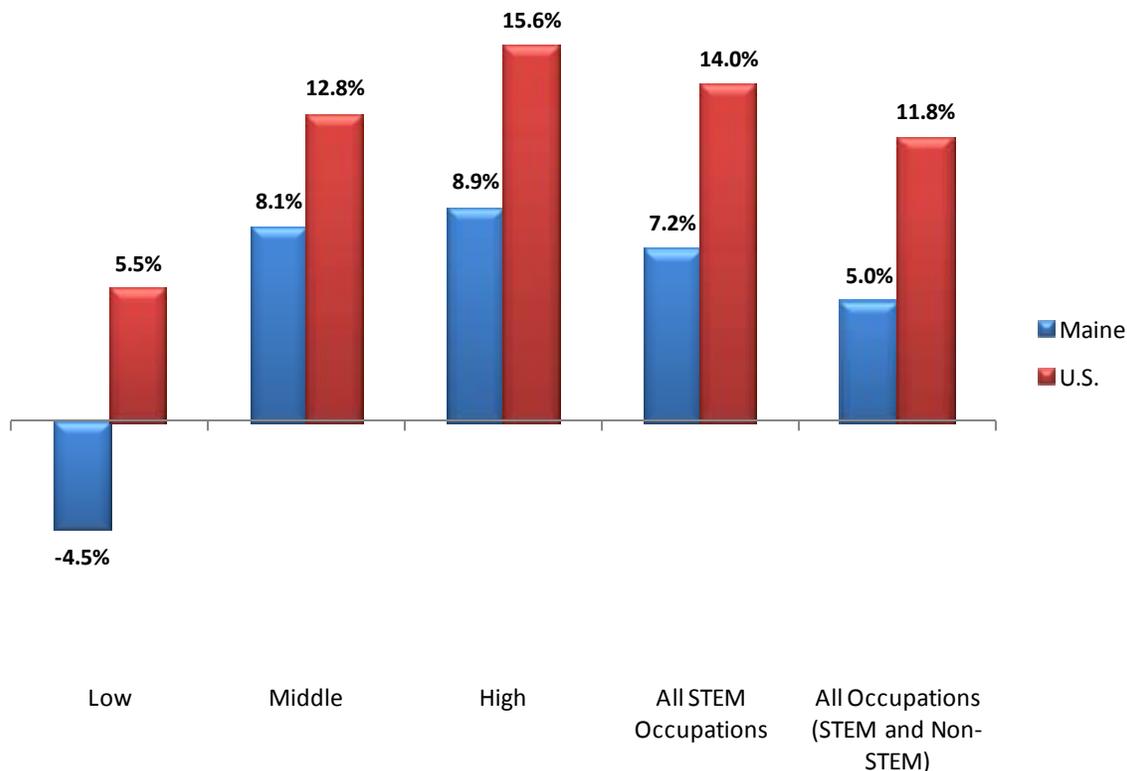
Figure 6: Historical Percent Change in STEM Jobs by Skill Level (2001-10)



Source: EMSI Complete Employment – 2011.3

From 2010 to 2021, STEM jobs are projected to grow faster in Maine as compared to growth in all jobs. In particular, the middle skill STEM jobs are projected to grow by 8.1 percent (see Figure 7).

Figure 7: Projected Percent Change in STEM Jobs by Skill Level (2010-21)



Source: EMSI Complete Employment – 2011.3

STEM jobs are no longer limited to high technology sectors; STEM and middle skill jobs now reach a broad range of industries and jobs. For example, construction, manufacturing, and natural resources-related sectors are estimated to create eight million jobs between 2008 and 2018. Thirty-four percent (2.7 million) of those jobs will require a post-secondary degree.⁸

These patterns are part of ongoing shift in occupational trends. In 1980, over 57% of middle skilled jobs were found in four industry sectors: manufacturing, transportation and utilities, professional and technical services, and education and health care.⁹ In 2006, these four industry sectors still account for more than half of middle skill jobs, but, as noted in Figure 8, the relative proportions have shifted. Between 1980 and 2006, manufacturing’s overall share of middle skill employment dropped precipitously (from 20.7% to 10.4% of jobs). In contrast, the percent of middle skilled jobs in professional services and education and health services rose by 62%, suggesting that middle skill STEM jobs are now an essential component in both manufacturing and service sectors.

⁸ Carnevale, et. al, 2010

⁹ Holzer, Harry and Robert Lerman, American’s Forgotten Middle Skill Jobs: Education and Training Requirements in the Next Decade and Beyond, November 2007

Figure 8: Middle-Skill Jobs by Major Industry Sector

Middle Skill Jobs by Major Industry Sector			
Industry Sector	1980	2006	Change (1980-2006)
Manufacturing	20.7%	10.4%	-10.3%
Transportation	20.3%	19.3%	-1.0%
Professional Services	8.3%	12.9%	4.6%
Education and Health	7.8%	13.1%	5.3%
Total for These Industry Sectors	57.1%	55.7%	-1.4%

Source: See Footnote 8

Data for Maine paint a similar picture. Between 2010 and 2021, demand for middle skill STEM jobs is slated to grow by 8.9 percent, far outpacing projected increases for all STEM jobs (up 5%) and those requiring a college degree or higher (up 7.2%).

Where Are Maine's Innovation-Based Middle Skill Jobs Found?

Combining data on overall middle-skill job growth with job projections in innovation-based industries helps us identify emerging middle skill employment opportunities in Maine's innovation economy. While middle skill STEM jobs are expected to grow rapidly in most industry sectors, the fields that are projected to have rapid growth are shown in Figure 9.

Figure 9: Projected Growth of Middle Skill STEM Jobs (2010 to 2021)

Middle Skill STEM Jobs Projected to Grow by More than Ten Jobs			
Occupation Description	Jobs 2010	# Change Jobs (2010-21)	% Change Jobs (2010-21)
Registered nurses	14,458	1,947	13%
Pharmacy technicians	1,712	334	20%
Medical assistants	2,271	325	14%
Farmers and ranchers	7,021	296	4%
Compliance officers, except agribulture, construction, health and safety, and transportation	1,286	259	20%
First-line supervisors/managers of food preparation and serving workers	4,293	201	5%
Dental hygienists	1,117	181	16%
Automotive service technicians and mechanics	4,654	173	4%
Dental assistants	1,008	158	16%
Cost estimators	686	130	19%
Veterinary technologists and technicians	518	119	23%
Respiratory therapists	516	91	18%
Radiologic technologists and technicians	1,201	89	7%
Surgical technologists	441	79	18%
Supervisors, farming, fishing, and forestry workers	1,277	64	5%
Biological technicians	616	53	9%
Industrial engineering technicians	339	48	14%
Medical and clinical laboratory technicians	692	44	6%
Emergency medical technicians and paramedics	1,367	42	3%
Medical records and health information technicians	776	42	5%
Licensed practical and licensed vocational nurses	1,847	40	2%
Cardiovascular technologists and technicians	212	39	18%
Healthcare technologists and technicians, all other	300	26	9%
Radiation therapists	91	17	19%
Surveying and mapping technicians	344	16	5%
Electro-mechanical technicians	173	14	8%
Diagnostic medical sonographers	192	14	7%
Environmental engineering technicians	215	10	5%
Life, physical, and social science technicians, all other	233	10	4%

Source: EMSI Complete Employment-2011.3

Who Prepares Mainers for Middle Skill Jobs?

Workers and students who pursue middle skill jobs do not follow the traditional higher education pathway where students move from K-12 education to a four-year college or university education. Instead, they typically follow a variety of education and training paths. Some students follow an education path that culminates in a two-year associate's degree at a community college. Others receive training from private and non-profit training providers or attend community college with the purpose of receiving a certificate or other training credential short of a full degree.

As these examples suggest, community colleges play a central role in educating and training our workforce, especially for middle skill jobs. Enrollment in community colleges has steadily risen over the past decade and are expected to continue rising over the coming decade. According to the American Association of Community Colleges:¹⁰

- 90% of our population lives within 25 miles of a community college,
- The average age of a student is 29 years,
- 80% of students work at least part-time,
- 30% are minorities,
- 44% of students receiving Bachelor or Master's degrees in STEM fields have taken courses or have transfer degrees from community colleges, and
- The average tuition is \$1,518 per year; total cost is \$2,544 per year compared to over \$7,020 per year for a public four-year institution.

Community colleges serve two important functions: 1) they provide degree and transfer programs for a variety of occupations, and 2) they provide valuable non-credit training that serves the needs of employers through customized training programs and industry-based certificate programs. As such, most community colleges have industry advisory committees or councils for various degree and training programs.

While they play a critical role, community colleges are not the only provider of training and education. Apprenticeship programs, private training providers, and even on-the-job training are also frequently used resources. These varied training providers generally work in close partnership with regional workforce investment boards (WIBs) to help align federal and state workforce funds with employer job projections and training needs. Conversations with college leaders in Maine, however, found that while college staff often sit on regional workforce investment boards, there was very little formal coordination to link WIB funding for areas like individual training accounts (ITAs) for workforce recipients to the capacity and programs at community colleges.

¹⁰ American Association of Community Colleges, "Community Colleges Can't Deliver for Us Unless We Deliver For Them" not dated

MIDDLE SKILL JOBS AND MAINE'S FUTURE INNOVATION ECONOMY

How can Maine Capitalize on this Opportunity?

The data presented in the first part of this report suggest a bright future for middle skill employment in Maine. Robust job growth seems likely, providing better pay and career options for many Mainers. Additionally, the data indicates that middle skills jobs are essential to the future of Maine's technology and innovation driven industries. Yet, for a variety of reasons, it appears that many employers are unable to find workers to meet this growing demand. At the national level, numerous studies suggest that, while middle skill jobs represent a large share of occupations and job opportunities, the labor force is increasingly lacking the skills for these jobs, especially those in traditional industries like manufacturing or engineering.¹¹

What explains the poor alignment between employment demand and workers' skills in these areas? At least three factors have been identified by Maine industry and education providers, and documented in national studies:

- Skills for degree and certificate programs are not keeping pace with employer needs, due to:
 - Weak networks. In regions with mostly small employers, those employers lack the time and resources to work proactively to change curriculum at the post-secondary level. Likewise, colleges typically have limited resources to aggregate such demand into a meaningful curriculum change. Indeed, partnerships between industry/employers and the colleges are sometimes weak.
 - A lack of student interest. Many directors of community college programs note that, while they have programs for service technicians, welders and other jobs needed by employers, they cannot seem to interest students in enrolling.
 - Cost. Limited enrollment or capacity for education and training programs are partially due to the higher than average course cost to develop and support technology-based programs.
- Student completion rates, especially for older and/or working students, are low with contributing factors being:
 - Student preparedness. A higher proportion of students require remedial coursework before entering programs, which increases the time and cost of their education.
 - A shortage of support resources. Cohort study groups, hands-on counseling, financial assistance, and help with transportation or daycare, are all proven to increase student completion rates. Yet, few of these support tools are readily available to working students.
 - Competing demands on students' time. Models for education delivery are not well suited for the changing demographics of students, especially the growing number of students who work at least part time or are older with children and family obligations.
- Funding and support for incumbent worker training is inadequate, leaving employers and educational institutions with few resources to train for the increasing number of replacement jobs.

¹¹ Reports include National Governor's Association Center for Practices, June 24, 2011 and June 11, 2007; Partnership for 21st Century Skills, *Are They Really Ready to Work?*, 2011; Innovation America, *Building a Science Technology, Engineering and Math Agenda*; Department of Labor, *The STEM Workforce Challenge*, April 2007

- Many middle skill occupations will be facing a large number of retirements in the next five to ten years (from nurses to welders and service technicians); yet most training resources are based on new jobs rather than replacement jobs.
- A lack of coordination between various funding sources for industry cluster efforts, making it difficult for industry consortia to develop well coordinated programs.

What Is Needed To Fill The Gap?

The Role of Community Colleges and Workforce Development Agencies

As we look to the future of Maine's innovation economy and projected demand for middle skill jobs in these sectors, we see two dominant trends. Demand for skilled workers is strong today, and will continue growing over the coming years. At the same time, Maine's community colleges, workforce development agencies, and other training entities are not fully addressing this demand and providing needed services to workers and to employers. The state is full of pockets of excellence when it comes to middle skill STEM training opportunities, but these leading programs are often isolated and insufficiently funded. A more robust system, built on stronger business partnerships, is needed if Maine wants to develop a stronger pool of talent for its innovation economy.

Maine can do better on this front, and some progress has been made in recent months. Some important business training consortia are emerging, and the state's workforce system is moving toward a much needed business demand-driven perspective.

Growing Demand

Data presented in the earlier parts of this report highlight aggregate demand for middle skill STEM workers in Maine. These numbers are further reinforced by the day-to-day experiences of employers and training providers across the state. Interviews with program directors at Maine's community colleges identified several pressing areas of demand. Advanced manufacturing, in fields like welding and precision machining, continues to be a high profile focus area. Employers are requesting programs such as precision machining due to upcoming retirements. Employers and colleges are having difficulty attracting workers to these fields.

From a training perspective, it is difficult to recruit students with both the interest and the needed math competencies to enter these manufacturing training programs. This is also true of apprenticeship programs, such as the successful efforts now underway at Portsmouth Naval Shipyard. Training providers speculate that this limited student interest stems from two potential factors: 1) Cuts in high school vocational education limit student exposure to these fields, 2) Students, parents, and educators are unaware or misinformed of the many attractive career opportunities that exist in these fields.

Student interest in some fields, such as IT and health care, remains strong. Yet many of these students, especially recent high school graduates, lack basic math skills and require remedial education.

Employers are beginning to mention renewed demand for information technology training, although specifics of those jobs remain somewhat ill defined due to the rapidly changing application of technology. Health IT, however, may be one area where regulation and industry trends will produce new training demands, and traditional IT operational jobs are likely to see steady demand as retailers, financial institutions and others embrace more electronic and online transactions.

A large portion of current community college programming is focused on "traditional" students, i.e., those enrolled full-time and/or pursuing a final degree option. Yet, community college leaders are trying new ways to reach out to students who work full-time or incumbent workers seeking to upgrade skills or learn a new field. Schools are trying a variety of methods to reach this population. However,

due to how non-credit programs are funded and supported, it is difficult for colleges to do alternative training on a broader scale. Yet to the extent possible, community colleges are accommodating non-traditional students by:

- Holding some classes on weekends and evenings;
- Offering more on-line courses;
- Offering free classes to employees of local companies so the company and worker see the value in ongoing training;
- Leveraging incumbent training through new-hire training; and
- Working with industry partners to develop HR and succession plans.

Without exception, community college leaders identified incumbent worker training as their greatest unmet challenge in the middle skills jobs arena. This has been a long-standing area of concern, but pressures are mounting as demand for better trained workers grows. Outside training funds for incumbent workers are limited. Federal funds have been cut, and few state programs support this activity, opting to instead tie training to new hires, as opposed to the existing workforce. Since non-credit efforts must be self-sustaining, it is difficult to start a new program without a large employer base or grant covering initial start-up expenses. In Maine, many employers are small and lack funds for training. Companies may be able to cover the cost of instruction, but when development and equipment costs are added, it becomes a different story

Growing Demand: The View from Industry

To obtain a better understanding of how industry views the demand for middle skill jobs and the connection to educational institutions, we held focus groups with leaders from two innovation-focused industries with strong current and projected demand for middle skill workers: information technology (IT) and advanced manufacturing. In these sessions, we asked about the role middle skill jobs play and what industry views as important skills and traits for these jobs. We also probed into how industry works with educational institutions and workforce organizations to ensure that there are qualified workers in the Maine labor pool.

A View from IT employers

IT jobs continue to come in many shapes and sizes. There are industries like finance, insurance, and retail that employ large number of IT workers to manage high volumes of electronic transactions. Others have products with software embedded in hardware and need workers with both IT and hardware knowledge, while still others require a blend of skills incorporating software development, computer science and media.

The majority of future IT jobs will continue to require a four-year or higher college degree; however, there will also be IT jobs with less extensive prerequisites. These jobs tend to be more operational and maintenance-focused in nature (e.g. database administration, network maintenance) or design-based (e.g. web design). For these jobs, experience is as important (and perhaps more so) than education level.

Since IT jobs vary and are embedded in so many industries, keeping up to date with IT skills is primarily the responsibility of workers. Companies were asked if industry or software certifications were of value and if they differentiated one employee from another. Almost all interviewees said they did not hold much value, except occasionally when selecting a contractor, and perhaps in more IT operations jobs. Instead, IT employers looked for workers that were self-motivated to learn, using the increasing number of blogs, social networks and user groups to keep up to date. Other certifications, such as project management, were viewed more positively, but, even in these cases, they might best be described as “nice to have” as opposed to being formally required.

When it comes to finding new workers, IT companies see great benefit in working with educational institutions. Much of the engagement by interviewed companies started with scholarships and internships, which were viewed as an excellent recruiting tool. Focus group attendees were unanimous in their enthusiasm for internship programs, to the point that one person advocated making them a mandatory part of post-secondary education. There was also significant discussion about having nontraditional internships – flexible ongoing work experiences for students, especially at the community college level. Interviewees noted that, in smaller companies, which have a difficult time hiring traditional summer interns, a more flexible internship (e.g. two half-days per week, year round) would be a better fit and provide a richer experience for students.

Several interviewed managers expressed interest in working with higher education on research or commercial projects that included both faculty and students. It was noted that, when compared to other states or countries (e.g. Ireland), Maine has no incentives to support such partnerships and a relatively limited system for making these connections. To date, most successful partnerships have emerged thanks to personal contacts. Whether for internships or R&D projects, the group agreed there was no central or coordinated way for Maine companies to make connections to the education system, and that a company must go school-to-school or campus-to-campus, which limits their ability to be engaged with education efforts.

IT industry leaders concurred that there is an urgent need to increase the number of high-school graduates interested in pursuing careers in STEM generally, and in IT and computer science in particular. Again, they noted that no system presently exists to promote this mission. Individual companies simply go it alone. For example, firms like UNUM hold events such as tech night for students, recruiting participants in a time consuming school-by-school outreach effort. IT leaders expressed strong interest in wider community partnerships that would help publicize and promote these careers to guidance counselors, parents, and students.

The problems of attracting widespread publicity and building scale were referred to in the focus group as the “rolodex problem.” Industry or industry consortia can continue to self-organize to create events for interested students, however, their impact is often limited. With support from the state, through its Department of Education, they can better inform students about events and can encourage students to participate. Guidance counselors should have their awareness of STEM subjects and careers increased too, perhaps by attendance at these events. This type of low cost concierge service would quickly allow industry to scale workforce projects and reach students in non-metro regions.

A View from Manufacturers

As in other regions of the US, Maine's manufacturing firms are in the midst of major challenges in terms of recruiting and retaining a workforce with the skills and talent needed to succeed in today's global marketplace. In the past, a worker with a strong back and a good work ethic could succeed and prosper in the manufacturing economy. In fact, Maine's long-standing competitive advantage in manufacturing stems to a large extent from the tremendous work ethic of past generations of Mainers.

Today, that strong work ethic must be combined with critical skills. Across the US, fewer workers bring this mix of competencies to the table. A recent report from Deloitte and the Manufacturing Institute found that, even at a time of high unemployment, US manufacturers face major skill shortages.¹² This nationwide survey found that as many as five percent of manufacturing jobs (up to 600,000 positions) go unfilled because employers cannot find workers with the needed skills—all this at a time when the national unemployment rate exceeded nine percent. Skills gaps appear most pronounced among technicians and skilled production workers---typically classified as middle skill jobs. Moreover, skills

¹² Manufacturing Skills Study 2011 found at <http://www.themanufacturinginstitute.org>

shortages are most pronounced among small and medium-sized firms, which are an especially important part of the economy in Maine.

Our interviews with Maine-based manufacturers, facilitated by the Manufacturing Association of Maine (MAME), found that local firms face challenges similar to those identified in national surveys. The MAME's periodic Manufacturing Summits also regularly cite training and workforce as primary challenges facing local firms. The latest summit, held in May 2011, produced typical results. With a few exceptions, business leaders from nearly every one of Maine's leading manufacturing sectors identified workforce development and training as their sector's #1 or #2 challenge area.¹³

For a variety of reasons, Maine's manufacturers have been at the forefront of the workforce development and training challenges cited in this report. The middle skills job challenges are not a new phenomenon for manufacturers; they have been facing this issue for years. They have worked for some time to develop a stronger pipeline for manufacturing talent. These efforts have succeeded in many cases, some of which are detailed below. Nonetheless, interviewed business leaders expressed great frustration with Maine's current training and education systems. Specifically, they highlighted several key points:

- Several existing programs, such as the Governors Training Initiative, provided some helpful support. However, those programs are no longer being funded. Existing programs provide limited funding for high need areas such as incumbent worker training.
- Several other programs, such as the Maine Manufacturing Extension Partnership's training programs, also provide excellent support but can only serve a relatively small number of workers.
- Maine's workforce development system is not working for manufacturers, and links to both the state Jobs Council and local WIBs are not effective.
- Maine's manufacturers have limited means to share their needs with education and training providers. These challenges hit small firms especially hard, as these companies lack the scale needed to attract high level training providers.

While manufacturers were critical of current support systems, they also recognized that effective partnerships are a two-way street. Businesses need to do a better job of articulating their training needs and in working with government and education leaders to address these gaps. MAME is taking the lead in this effort with the recent decision to sponsor Industry Advisory Councils in three areas of pressing workforce shortages: welding, machining, and radio frequency electronics. Similar groups are also being proposed for other manufacturing and health care related sectors.

This approach, which is modeled on approaches pioneered in Pennsylvania, creates a truly demand driven workforce system.¹⁴ Manufacturers develop a list of pressing training needs, and then reach out to community colleges or other training providers to help address these needs. This approach has many benefits. For firms, they can aggregate demand and reduce training costs through group purchases. For training providers, they can better identify new market needs and provide training that is truly needed.

These demand driven models have succeeded in other states, but are relatively new to Maine. New consortia are just being started, but they are generating great interest from Governor LePage and other state leaders. It is likely that these new demand driven models will become the norm for future workforce development efforts in Maine.

¹³ Manufacturing Association of Maine, *2011 Manufacturing Summit Report*.

¹⁴ For background, see Stacy Wagner, "Leveraging Close ties to Business and Industry Employer Associations as Workforce Intermediaries." CAEL White Paper. 2006.

Building the Pipeline: Creating a New System for Middle Skill STEM and Innovation Jobs

Maine companies need to upgrade their workers' skills to remain competitive. If the innovation economy demands lifelong learning, new systems to provide such training will be required. Community colleges and other training providers are responding by finding ways to leverage resources---using facilities at vocational and high schools, sharing curriculum, and so on.

There are many bright spots in this field across the state of Maine. Below, we have highlighted four prominent examples of programs that are doing a good job of training middle skill workers for positions in Maine's innovation economy. These model programs share several traits; they are built around strong industry-education partnerships along with an initial funding source (typically a government grant matched with other funds) that allowed for adequate development of an ongoing program as opposed to a one-time pilot project. Robust funding equals effective capacity building, allowing for the construction of sufficient infrastructure to sustain interest and engagement by partners and allow for the scale up of training as needed.

Central Maine Community College & Advanced Manufacturing Companies

A good example of different educational institutions leveraging resources and expertise and partnering with industry to give students applied experience alongside education.

Much of today's manufacturing is designed, developed, and prototyped at different locations. It requires workers to have a strong team orientation as well as the ability to utilize internet and web-enabled technologies for design and communication. **Central Maine Community College (CMCC)**, in partnership with three other community colleges, a university and firms across three states, has developed **the Virtual Ideation Platform (VIP)**. VIP builds on the various competencies of its key partners with different schools focused on, respectively, design work, R&D, and prototype development and testing. However, project work occurs via cross-institutional teams that enable faculty and their students to effectively collaborate on real industry projects. Students share resources and expertise to resolve complex design and performance requirements and build entrepreneurial skills along the way. Challenging projects undertaken included consumer goods, assisted living devices, metrology tools, and tooling for industry. To date, VIP projects have catalyzed the creation of three new businesses that grew out of student projects.

In Phase II, the project will expand partnerships with new community colleges and universities in Maine and nearby states with expertise in fine axis machining, advanced automation and assembly, intellectual property rights, and mechanical testing. Students and faculty will be able to undertake increasingly complex projects with access to additional laboratory facilities and expertise.

Southern Maine Community College and the Composites Industry

A good example of how industry groups partner with colleges to train workers, enhance curriculum, and build ongoing workforce capacity.

Maine has a deep-rooted **composites industry** that is tied to a variety of other manufacturing and materials industries. The need to train new workers and keep existing workers up to speed is no small task. The **Southern Maine Community College**, in partnership with industry associations, workforce organizations, and others developed an advanced technology center to:

- Train 800-1,000 workers over a span of four years,
- Develop an associate degree in Composite Technology,
- Develop a national certified composites technician training, and

- Increase K-12 career awareness for the industry.

While the project was kicked off with a Department of Labor grant, the strong industry-education partnership allowed the project to be implemented in rapid fashion and at a high level of quality. Industry provides instructors and works with the Center on quality assurance and testing for industry issues and products. This program developed the first-in-the-world certified composite technician for vacuum infusion process. The program not only trains Maine residents; over 40% of the participants are from other areas of the country.

York County Community College & Portsmouth Naval Ship Yard

A good example of alternative training programs where employers partner with educational institutions to provide students a way to learn skills and earn credits while also earning a living.

The need for financial resources can make it difficult for many students to attend school full-time. Apprenticeship programs can offer an alternative way of learning a new career while being employed. It is an underutilized method to train for middle-skill jobs, yet Maine has a well-known apprenticeship program at the **Portsmouth Naval Shipyard**. The Portsmouth Naval Shipyard is the second largest employer in the Seacoast, employing approximately 4,500 civilians. The Shipyard Apprentice Program's Trades Apprenticeship trains applicants in various skilled trades. The shipyard has Memoranda of Understanding with **York County Community College** to earn credits towards associate's degrees in Trade and Technical Occupations and Technical Studies.

This four-year apprentice program features paid academic and trade training, and on-the-job learning. All training is conducted at Portsmouth Naval Shipyard. Credit may be given for previous work experience and/or training. Benefits include four hours of vacation and four hours of sick leave for every 80 hours of actual work, a retirement plan, Thrift Savings Plan (similar to a 401K) and optional employer-subsidized health and life insurance.

Apprentices attend academic classes at the shipyard with trade training typically conducted in the shop areas. Apprentices must successfully complete all courses prescribed in their trade-training plan. Graduates receive journey worker certificates from both the Department of Labor and Department of Navy, and receive college credits towards an associate's degree from York County Community College.

Kennebec Valley Community College (KVCC) and Alternative Energy

A good example of how colleges can become not only a good training base for local industry, but serve to be on the leading edge of national training.

Located in Fairfield, Maine, KVCC has created a program to increase the quality and availability of training in the installation of solar energy systems in the Northeast. The program serves students, workers and private companies throughout the Northeast region with participants from Connecticut, Massachusetts, New Hampshire, New York, Rhode Island, Vermont and Maine. Funded as part of a national Energy Department-backed Solar Instructor Training Network, KVCC's program is one of nine regional training centers across the US.

The program is based on industry standards and participants will be eligible to pursue industry-based certification. KVCC's classrooms are equipped with hands-on training materials like rooftop mock-ups and people attending their trainings can even practice on the roof's live solar thermal system. A key part of this program is to train instructors so that new solar skills can be taught to an array of individuals and reach beyond the student body of one community college. Professional development activities will target instructors from community colleges, career & technical education centers, apprenticeship programs and private industry training incubators in the Northeast Region who are looking to enhance

their existing plumbing; heating, ventilation, air conditioning (HVAC); pre-engineering, and environmental technology programs.

MOVING FROM POCKETS OF SUCCESS TO A SYSTEMS APPROACH

Even the strongest industry critics agree that Maine is home to a number of world class training programs and initiatives--in middle skills areas and elsewhere. Yet, because of limited resources and other issues, these model programs often exist in isolation. They provide excellent training support, but their scope and reach is constrained. The ability to replicate and sustain promising projects is severely limited.

Our interviewees identified a number of key challenges to replicating or sustaining successful programs

Limited Resources and Changing Needs of Small Companies

Reaching out to meet the training needs of smaller firms is extremely difficult. The process is time consuming, and firms have limited resources and time availability to pursue training and education opportunities for their workers. For small businesses, the issue is not one of lack of interest in training, but an inability to pay for the training for their workers. The Maine Quality Center program seeks to help fill this funding gap, but its rules require that it primarily support firms seeking to hire new workers. Meanwhile, Maine businesses have a pressing and unfilled need to retrain and upgrade the skills of their incumbent workers.

Limited Student Interest in Training Opportunities

Like small businesses, potential students also face financial constraints. Many recent high school graduates and unemployed or underemployed adults lack the resources to pay for training programs, and may also question the benefit of these large educational investments in a job market with what is perceived to be few direct post-training employment opportunities. Furthermore, there is a lack of up-to-date information about middle skill careers, so many students perceive these opportunities as low-paying jobs in dying industries. Thus, finding eager trainees has also proved a challenge for many programs.

Growing Program Costs and Growth Management Challenges

Middle skills job training programs require significant start-up investments, especially in innovation-based industries where specialized—and expensive—training equipment is needed. As a result, these training programs are more costly on a per-student basis, and are difficult to scale up in the event of rapidly increasing demand. Expanding programs requires new equipment purchases and other investments, making it difficult to develop a rapid response to industry needs. These high costs often place non-credit middle skills training programs in the budget cross-hairs. When school budgets get tight, expensive programs may face the chopping block--even if they are doing a good job at meeting industry needs and closing key skills gaps.

Limited Funds for Non-Credit Programs at Community Colleges

Community colleges pursue a variety of missions, from providing open access to education, to promoting the transfer of students to four-year institutions, to supporting businesses and local community needs. Within this array of competing missions, colleges place greater or lesser weight on their non-credit programs. In some schools, a perception exists that non-credit training is a secondary mission of the college even though it is critical for the revenue base of the college (most programs pay for themselves and then some). Non-credit programs are very useful, especially as the need for incumbent workforce training continues. Many observers fear that there are inadequate resources to cover the growing student enrollment and demands from local industry.

MOVING FORWARD: FIRST STEPS TO SYSTEM BUILDING

In the coming years, the health of Maine's innovation economy will depend to a large extent on its ability to nurture and access the essential fuel for all innovation: talent. This talent base will take many forms, from young people with a dream to be entrepreneurs, to highly trained scientists and researchers, to skilled technicians, mechanics and specialists. This latter group, the middle skill cohort of the innovation economy, is the least recognized, yet one of the most important drivers of these critical science and technology focused industry sectors.

Across Maine, businesses face severe challenges in grooming a new generation of middle skill talent. As many workers in skilled trades retire from an array of industries, they must be replaced with equally qualified workers or, preferably, workers with even greater technology, project management and entrepreneurial skills.

Business leaders remain concerned that students are not adequately aware of middle skill career opportunities and the information received from guidance counselors and workforce counselors may be incomplete. Industry in Maine appears to be more than willing to step up to the plate and develop career materials and scale up their career exploration efforts, especially if the connection to schools is more effectively coordinated.

STEM skills are increasingly essential to middle skill jobs ranging from those in health care (an increase in technology for diagnosis, treatment and case management) to those in manufacturing, energy or IT. Adequate capacity for these classes is essential. With a number of students needing remedial coursework and flexible scheduling, colleges must design alternative delivery models besides a daytime classroom to provide access STEM coursework or prerequisites.

Community colleges, especially noncredit divisions, are forming viable industry partnerships and collaborating with industry when resources allow. However, given the limited nature of resources for new program development, it is difficult to build ongoing capacity for training without a significant federal grant or industry donation.

Thus, Maine faces a situation where all sides, including business, government, and education, recognize the problem and are ready to step up to address it. To date, these efforts have produced a series of successful programs and training initiatives that seem to work for one firm, one industry, or one location. But, they lack scale and scope, leaving many businesses and many potential middle skill workers on the sidelines.

While the scope of this case study was not intended to evaluate existing programs and policies, our assessment of middle skill jobs did point to a set of criteria and characteristics are critical for successful workforce efforts in this arena.

For Educators and Training Providers:

- Place greater emphasis and resources on non-credit programs to provide them with a more sustainable funding base. Create new performance-based premiums that would reward non-credit programs that meet and exceed employer training milestones.
- Create new scholarship and internship programs that introduce students to middle skill careers, focusing on flexible or nontraditional internships that could more easily attract the participation of small and medium size firms.
- Create partnerships with industry where career and guidance counselors can learn of the range of middle skill career opportunities available in Maine.

For Government Agencies and Workforce Development Organizations:

- Fund programs to support training for incumbent workers. This was a high priority for both industry and educational institutions, with a repeated suggestion to allow workforce training funds to be used for high demand replacement jobs as well as for new jobs.
- Improve connections among state funds for cluster and related industry efforts, especially innovation-based funding managed by MTI and those managed through workforce development channels. This would help industry groups develop more coordinated and scalable programs that are based on market demands and address human capital needs along with other cluster challenges.
- Consider introduction or expansion of outreach campaigns to youth and parents with interest in new middle skill careers. Tie these efforts to existing STEM outreach programs and establish a more centralized approach within the state's education system for industry to work with and reach participating schools.
- Collaborate with industry to develop training consortia for all key innovation economy clusters now supported as part of Maine's Science and Technology Plan.

For Industry:

- Create or expand industry consortia that include smaller firms to develop criteria for industry based training needs and to collaborate with community colleges and others to provide training. This could be supported by more coordination between state supported cluster funds (see recommendation for Government Agencies).
- Work with K-12 and STEM programs to ensure career information contains updated and accurate information about middle skills opportunities. Actively work with guidance counselors to ensure their understanding of these opportunities.
- Use industry associations and consortia to share employer outreach models and develop more coordinated ways to expand outreach to schools with programs such as Tech Night Out, Building Bridges and others.

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