

PRIME – the Partnership for Regional Innovation in Manufacturing Education

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I. Introduction

The manufacturing base of Southwestern Pennsylvania is the key to a healthy regional economy. Manufacturing is the second largest private sector employer with 166,000 jobs, and first in annual wages with a total payroll of over \$6 billion^{1, 2}. The average manufacturing wage of \$40,000 compares very favorably to the \$28,000 average of other sectors. Figures 1 and 2 further underline the importance of manufacturing to southwestern Pennsylvania – by showing the impact that the relatively small number of manufacturing jobs has on the regional economy.

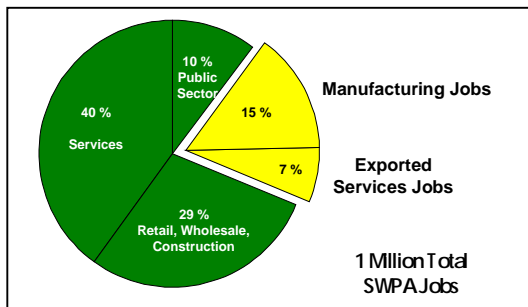


Figure 1. Breakdown of Regional Jobs

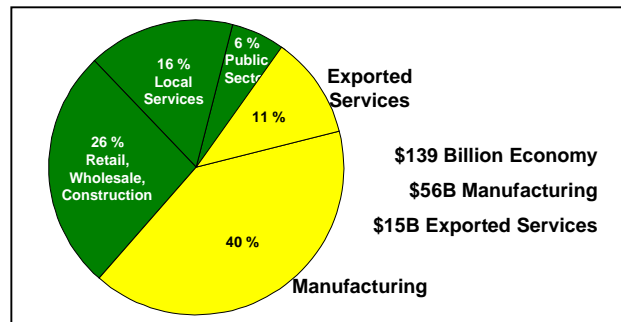


Figure 2. Impact of Manufacturing

This essential regional economic base is being threatened by a critical shortage of skilled technicians and engineers needed to sustain and grow the region's manufacturers³. This is further complicated by the fact that the industry base in Southwestern Pennsylvania is no longer dominated by the steel industry. Manufacturers in the region now exhibit significant diversity in materials, processes, and technology thereby challenging the educational system that needs to be in place to prepare the regional workforce.

At a time when manufacturers cannot recruit a sufficient number of skilled workers, there is a segment of the region's workforce that is under-employed and often working in the service and retail sectors for much lower wages. The projected retirement attrition rate of 5% per year in the manufacturing sector further exacerbates this situation. This disconnect in the deployment of the regional workforce is the impetus for five Southwestern Pennsylvania participating educational institutions to recruit and educate the kind of workforce demanded by the region's manufacturers while simultaneously providing new and rewarding career paths for the region's youth. Clearly

something must be done to reverse this trend – initiatives must include both education and training of the current as well as incumbent workforce. The Partnership for Regional Innovation in Manufacturing Education (PRIME) was created to address this fundamental mismatch between the labor market and the economy.

II. The formation of PRIME

PRIME brings together Robert Morris College (RMC), Penn State New Kensington (PSNK), the community colleges of Allegheny (CCAC), Butler (BCCC) and Westmoreland (WCCC) counties and dozens of manufacturing partners. Before the formation of the coalition each academic institution conducted extensive research with regional industry. It may be noted that diversity was achieved in terms of the types of industry surveyed (SIC codes 20 through 39 were represented) and in the sizes of the manufacturers that were studied. The list included companies like Cutler-Hammer, Mine Safety Appliance, General Motors, Adtranz, Penn United Technology, Medrad, Oberg Industries, PPG Industries, J & L Specialty Steels, and Penn State Tool and Die, among other industry partners.

The purpose of the study was to identify regional needs for technicians, technologists, and engineers working the field of manufacturing. Specifically, the colleges targeted industry perceptions of the competency gaps that are commonly seen in newly hired graduates. This followed the report entitled “Manufacturing Education Plan: 1999 Critical Competency Gaps” by the Society of Manufacturing Engineers^{4, 5}. In interviews, manufacturing and human resource managers in diverse industries cited the need for a workforce with a continuum of technical skills to meet the demands of new technology and increased domestic and international competition. The findings of the study appear in Table I.

Table I. Competency Gaps to be addressed by PRIME

Competency Gap	Institution				
	RMC	PSNK	CCAC	BCCC	WCCC
Business knowledge skills		X		X	
Communication skills	X	X			
Specific manufacturing processes		X		X	
International perspective				X	
Manufacturing process controls	X		X		
Manufacturing systems and principles	X				X
Quality			X		
Problem-solving	X	X			
Teamwork					X
Materials	X		X		
Engineering Fundamentals		X			

The needs of the region demanded an innovative systemic solution in order to close the competency gaps identified by the industry partners, provide access to both incumbent workers and high school graduates, and address the broader economic needs of the region (See Figure 3). The solution that was developed took the form of eight-county system of seamlessly articulated, industry-driven education, involving five the institutions as equal partners. This partnership was named PRIME and its structure appears in Figure 4. Initial funding for PRIME has come from

the Education Foundation of the Society of Manufacturing Engineers and the Heinz Endowments.

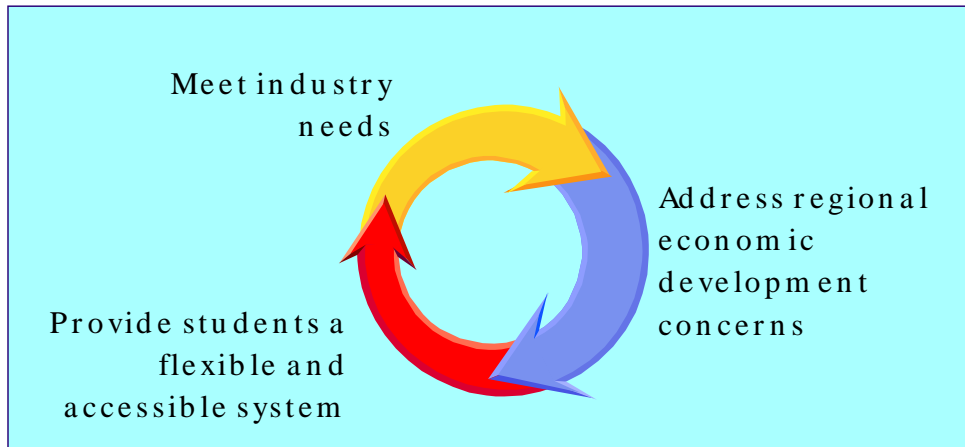


Figure 3. The PRIME Solution

Some of the innovative features of the PRIME collaboration are:

- The number of new, creditable manufacturing programs being created by PRIME. These include^{6,7}:
 - A four-year Manufacturing Engineering degree (RMC)
 - Two-year and four-year Manufacturing Engineering Technology degrees (PSNK)
 - Three two-year Manufacturing Technology degrees (CCAC, BCCC, WCCC)
 - A three-year Technology to Engineering bridge program (CCAC, articulated to RMC)
- A region-wide interconnected educational system (see figure) that fosters learning at different levels, at times and locations best suited to technicians and engineers
- Comprehensive involvement of industry at all strategic and operational levels
- Diversity by size and SIC classification of the industry partners

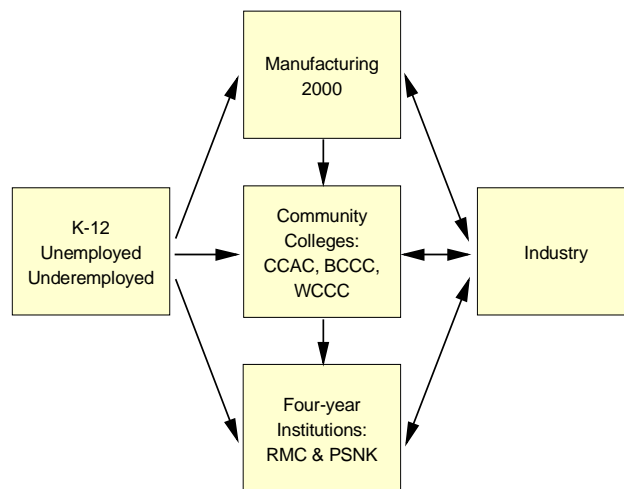


Figure 4. PRIME Partnership

III. PRIME Activities

The creation of the PRIME partnership involved activities at each institution as well as coalition-wide activities. These are now discussed. Each institution is undertaking the following activities with the initial funding that the coalition has received:

- Develop or modify curricula and facilities to address the competency gaps identified by industry
- Transform industry advisory committees into joint faculty-industry steering committees to guide and continuously improve the curriculum
- Develop articulation agreements amongst themselves
- Improve relationships with industry to offer time- and place-appropriate, highly relevant, industry specific, real-world learning experiences for students through internships and projects

In addition to these common needs, each institution has a niche resulting from its strategic position and industry needs specific to that part of the region.

At Robert Morris College this has taken the form of the Computer Integrated Engineering Enterprise – the Learning Factory. The mission of this learning factory is to support the B.S. in Manufacturing Engineering and educational programs college-wide, serve as a test bed for research and development activities, support College outreach and recruitment activities, and provide an environment for lifelong learning. The College has dedicated 7,500 square feet to the facility. PRIME funding, matched by school and industry funds will be used to implement an automated machining cell, an automated assembly/inspection cell, and a rapid prototyping facility. When complete, this laboratory will constitute a full production system that will allow students to take a product all the way from concept through design and on to final manufacture. This facility will support all engineering courses and will also support business, science, and mathematics courses by providing actual production data and system for analysis, control, and integration in near real time.

At Penn State New Kensington, the emphasis for the Associates and Baccalaureate degrees in Manufacturing Engineering Technology is on tool and die manufacturing, electro-optics, and general manufacturing. Students will also have access to programs in plastics manufacturing at the Behrend campus and nano-fabrication at the State College campus. Industry-focused certificate programs that will be developed and offered in short order will precede the actual degree programs. The laboratory component of several courses will be offered at the nearby Manufacturing Assistance Center operated by the University of Pittsburgh.

The Associates degree in Manufacturing Technology offered by the Community College of Allegheny County and the three-year bridge program to Robert Morris College will focus on the areas of controls, automation, metrology, and quality. The CCAC vision for this degree program is based in the control of the manufacturing process through automation. This will involve use of the computer for data acquisition of process information and the analysis of the information using techniques such as Statistical Process Control. In addition to space available on campus,

CCAC will lease space at the nearby Steel Center Area Vo-Tech. The long-term plans are to create and house an Advanced Manufacturing Academy on the CCAC campus.

The Associates degree in Manufacturing Technology offered by the Butler County Community College will focus on tool and die manufacturing and plastics manufacturing. Building on strong existing programs in design and metrology, the new program will emphasize team skills, project management, international relations, and business skills in the context of these manufacturing focus areas specified earlier. The new Manufacturing Technology degree and manufacturing option in the General Engineering transfer program will be supported through the use of existing and the development of new lab facilities. BCCC will break ground this year for a new building, a portion of which will be dedicated to the Manufacturing Processes Lab. This new facility will allow the college to update and expand its current lab space. BCCC has also formed a partnership with Penn United Technology, Inc. and will use its newly opened state-of-the-art training facility for a number of tool and die courses.

The Associates degree in Manufacturing Technology offered by the Westmoreland County Community College will allow the institution to consolidate and reorganize its offerings in manufacturing. WCCC will create a new program and position its existing programs to offer options in Chemical Processes, Electronics Technology & Assembly, Manufacturing Processes, and Manufacturing Maintenance under the "umbrella" of a Manufacturing Technology degree program. The new Manufacturing Technology degree would feature a common first-year curriculum, consisting of basic skill courses in math, electronics and manufacturing, and other core requirements with area-specific specialization in the second year. The process of consolidation has extended to physical facilities in that all of these options have been co-located for purposes of cohesion. The result is a blend of theoretical and experiential learning and is also structured to focus on team skills.

At the coalition level, PRIME has initiated a set of activities to create a world-class environment for manufacturing in southwestern Pennsylvania. These include:

- Benchmarking and sharing the best in class that each institution has to offer by facilitating the adaptation of curriculum modules developed in one institution for use by the others.
- Provide open access to each other's facilities and seek opportunities to engage students in shared learning experiences.
- Organize an annual academic-industry forum to foster peer learning among faculty, students, and industry and to provide opportunities for students to demonstrate mastery of technical, teamwork and communication skills in a professional setting.
- Form a system of governance to better manage the academic/industry relationships and position the involved institutions to deal with issues of portability, growth, standards, and shared measures of excellence.
- Provide a structure that will facilitate interface between PRIME and K-12 programs that encourage exploration of careers in manufacturing and between PRIME and certificate and apprenticeship training programs in manufacturing occupations.

As a coalition PRIME has its own identity, a web site, and a toll-free telephone number for easy access by the community at large. The coalition intends to undertake project assessment using

metrics/processes such as external evaluators; surveys; testing programs such as Work Keys, the Certified Manufacturing Technologist, and the Fundamentals of Engineering; articulation; and accreditation⁸.

IV. Project Management

PRIME has established a multi-layered governance structure. At the institutional level, *Industry Steering Committees* are responsible for the "nuts and bolts" activities of PRIME such as curriculum/laboratory development, and maintenance of industry relationships. At the coalition level, the PRIME *Oversight Committee* is charged with monitoring and ensuring delivery of coalition activities. The entire structure will be guided by a *National Advisory Board*, empowered to bring a broader perspective and increase PRIME's sphere of influence.

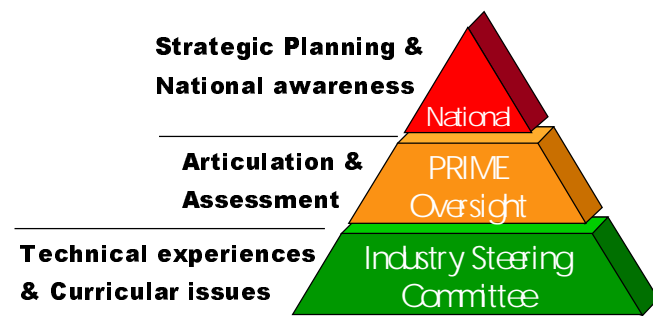
Industry Steering Committee

Each institution has established Industry Steering Committees that are co-chaired by an industry representative and the co-PI's for this proposal. These Steering Committees are working groups with a major role in curriculum and laboratory development, internships, development of problem-solving opportunities using teams, and sponsored projects. These committees are responsible for monitoring the quarterly deliverables established for the project and ensuring that elements of each institution's proposed programs are being kept on schedule and on track.

PRIME Oversight Committee

In addition to the activities that occur at the institution level, PRIME calls for a set of coalition activities. The initial Oversight Committee is composed of one academic representative from each institution, one industry partner from each institution's Industry Steering Committee, and

Dr. Sharon Wheeler from the Heinz Endowments. The Oversight Committee is co-chaired by Dr. Erevelles – the Project Director and an industry representative. The Oversight Committee will be charged with the overall implementation of PRIME and other activities that may be required by future funding. The Oversight Committee is responsible for planning and setting priorities for the coalition.



National Advisory Committee:

It is recognized that there is an arena of activity at the state and national level in which PRIME should be engaged. A National Advisory Committee can facilitate the establishment of relationships with similar or complementary efforts, can elevate PRIME's profile, and can assist PRIME in working through regulatory issues that might impede full implementation of articulation agreements or other aspects of the coalition's activities. The membership includes Brian Kelley from the Heinz Endowments, the Presidents of the five institutions that comprise PRIME, nationally known manufacturing engineering educators, and manufacturing executives who are nationally known for their manufacturing expertise, experience, and leadership.

V. Expected Impact of PRIME

PRIME expects to create the integrated educational system needed to meet industry, student/trainee, and regional economic needs southwestern Pennsylvania. PRIME builds on basic scientific and mathematical principles and skills to establish workforce competencies in manufacturing. Specifically, PRIME is expected to benefit the region in the following ways:

- Impact 1250 students seeking pre-employment education or a skills upgrade for career advancement over the next 5 years through a combination of traditional (full-time), non-traditional (part-time), and industry-based certificate instruction;
- Serve as a replicable and portable model for competitive collaboration and regional development;
- Link K-12 and certificate and apprenticeship programs to a region-wide articulated system of higher education;
- Create a regional network for learning at different levels, at times and locations best suited to new and incumbent technicians and engineers;
- Create and upgrade curricula and facilities at all partner institutions; and
- Engage the vigorous and in-depth participation of over fifty industry partners to guide and continuously improve regional and national manufacturing education.

V. Summary

The PRIME coalition is now in its first year of existence. The progress made by each of the partners and the coalition as a whole is consistent with the timeline established for the first twenty-four months of the project. The coalition has submitted a proposal to fund the joint development of curricula and courseware and is preparing several proposals to fund the development of pre-college programs that will serve as the feeder to the five participating institutions.

The infusion of funds by the SME Education Foundation and the Heinz Endowments, the time invested by the industry partners, equipment donations from industry, and the relationships cultivated with the industry vendors have allowed the partners to quickly progress towards the goals set for this coalition. The process of growing the talent pool for the manufacturing sector in the region is an ongoing one. As the project matures, the number of students drawn into programs and careers in manufacturing will increase significantly. This will further strengthen the existing manufacturing base in the region, and the increased technical workforce will attract new businesses to the region

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