The Hidden Innovation Infrastructure Project: Understanding the Economic Development Role of Technician Education in the Changing Future of Work

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Abstract

The Hidden Innovative Infrastructure (HII) project explored how technician education programs could be better integrated into broader economic development strategies, ensuring greater innovation in manufacturing and stronger manufacturing communities. To observe current program dynamics across disparate geographies and manufacturing sectors, the Rutgers University Education and Employment Research Center (EERC) partnered with eight community colleges to investigate the regional economic development role of technician education.

This report describes the findings from cross-case comparison research. Findings include:

➢ Community colleges fill knowledge and coordination gaps created by regional variation in manufacturers' capabilities, both within and across regions.

➢ Administrators ensure degree-granting and short-term-training programs are dynamically linked to the technological innovation capacity of their large regional employers as well as to community development priorities.

➢ To deliver effective programming, college administrators and faculty embed in broader economic development ecosystems. In more mature ecosystems, these efforts include embedding in robust industry associations and even industry-specific educational alliances. Where manufacturing sectors are less developed, college leaders may have to create new mechanisms for coordination.

Some approaches to technician training by community colleges have the potential to improve local industrial advantage and the quality of local jobs, shifting the trajectory of the region. Too often, the links to economic development results are not explicit and important contributions to high-tech manufacturing remain "hidden."

To continue making progress toward generating more innovative firms that contribute to stronger regional ecosystems, federal, state, and local leaders can work together to identify high-impact programs that deliver results. To do that effectively, college administrators and faculty running programs related to advanced manufacturing could be strategically integrated into economic development planning for the sector. For example, federal agencies, state agencies, and other funders could encourage connections between college program leaders and local economic development leaders to assess how their regions will navigate anticipated technological change in the advanced manufacturing sector. Program evaluation toolkits and funding proposals could more explicitly link and measure connections that lead to industry innovation and regional impact. With these resources, colleges can more intentionally recognize and bolster efforts to promote regional economies.

Introduction

For more than 30 years, the Advanced Technological Education (ATE) program at the National Science Foundation (NSF) has promoted innovative programming at community colleges, pioneering new models to develop technical science and engineering skills. Many of these programs aim to provide the new foundational skills required for high-tech, US-based manufacturing.

Researchers have demonstrated how the delivery of these programs via American community colleges can both provide workers with increased access to good jobs in manufacturing and supply manufacturers with a broader talent pool. It follows that increasing and enhancing community college offerings can improve outcomes for workers, firms, and regional manufacturing ecosystems.

Yet, technical talent alone does not power resilient manufacturing regions capable of responding effectively to technological change. Firms must leverage the skills of those trained workers, and regional leaders must equip the broader manufacturing ecosystem to support innovation. Community college administrators, faculty, and instructors can strengthen these important connections from the classroom to the shop floor and beyond.

By looking both within and across technician education programs, we were able to (1) label and acknowledge the work these programs do in economic development terms; (2) probe variation in the way programs operate, lifting up opportunities for learning across case study sites; (3) uncover important tensions technician education program leaders confront and explore relevant solutions; and (4) underscore the agency of community colleges as it pertains to their role(s) in regional economic development processes. Ultimately, we describe how these community college role(s) can help regional leaders deliver on the promise of high-tech manufacturing for communities nationwide.

Report Structure & Insights

This report contains three substantive chapters that build on the HII conceptual model shown in Figure 1:

- ➤ **Chapter 1** describes three types of economic development activities conducted by the eight community colleges—those oriented toward worker-, firm-, and region-level results.
- ➤ **Chapter 2** describes the activities of the colleges from the employers' perspective.
- ➤ **Chapter 3** describes the perspectives of the colleges' regional economic development partners. By identifying regional similarities and locating perspectives on a spectrum, this chapter identifies ways to enhance regional economic development processes.

Figure 1. HII Conceptual Model

HII Conceptual Model for Community College Engagement with Economic Development

Source: Van Noy, M., Weaver, A., Forbes, A., & Bragg, D. (2023). *The community college role in economic development: A conceptual model.* Education and Employment Research Center. Rutgers University.

Our Approach

Through the Hidden Innovation Infrastructure (HII) project, we investigated whether particular strategies used by community colleges to engage in economic development could amplify the impact of manufacturing-focused technician education programs. To do this, we selected eight community colleges for study and talked to college staff, regional employers, and regional economic development organizations about whether and how approaches to technician education could be linked to broader economic development processes. Grounded in cross-case analysis, the following chapters contribute to a more robust roadmap for the technician education community to not only demonstrate and strengthen connections between community colleges and regional economic development processes but also to deepen their impact on both regional manufacturing ecosystems and their surrounding communities.

Each community college included in the study features exceptional community college technician education programs. Our data collection covered the activities, actors, and strategies involved in their execution. At each site, we examined employer partners' perceptions of the programs and their graduates, as well as the regional economic development partnerships that support the community colleges as operators of key technician education programs designed for their respective regional manufacturing bases.

Case Study Site Selection

The HII research team conducted case studies of eight community colleges, focusing on two advanced manufacturing associate degree program areas at each college. The colleges were spread across four US states: three colleges in Arizona, three in Ohio, one in Wisconsin, and one in Florida.

We selected cases that represent strong examples of how technician education could be linked to regional economic development. Colleges across the Great Lakes region exemplify programs operating within maturemanufacturing sectors undergoing revitalization, and those in the Sunbelt region exemplify programs within booming economies and manufacturing specializations. Across the sample, college service areas reflected a mix of urban, suburban, and rural areas.

The colleges selected are located in the following regions across the four states: (1) Dayton-Columbus-Lorain County, Ohio; (2) Phoenix-Tucson, Arizona; (3) Daytona, Florida; and (4) Milwaukee-Racine-Waukesha, Wisconsin. Our case study colleges were Lorain County Community College, Clark State College, and Columbus State Community College in Ohio; Pima Community College, Mesa Community College, and Estrella Mountain Community College in Arizona; Daytona State College in Florida; and Gateway Technical College in Wisconsin.

Factors that influence the economic development contributions of the colleges in this study include: (1) the dynamics of the regional labor market, notably demographics and migration trends; (2) the local history and current configuration of the firm/industry landscape; and (3) the extent and nature of state-level support. In particular, the significant role of state support became pronounced over the course of this study; we elaborate further below.

State-Metro Contexts

Case study regions were selected to represent a mix of geographies with different state and local conditions. The inclusion of three schools in Arizona and three schools in Ohio allowed us to observe important variation in state-local relationships and relationships between colleges within the same state.

> ➢ **Arizona:** The Phoenix-Tucson region of Arizona encompasses both rural and urban areas, and the manufacturing industry is expanding. All three of the selected colleges in this metro area work together on economic development efforts that have been funded by the state. The region was home to the previously operating ATE-funded Maricopa Advanced Technology Education Center (Phoenix area) and the Center of Excellence in Applied Technology (Tucson area). The Maricopa County Community College District (including two of the case study colleges) has received NSF ATE funding. A key economic development partner of our Arizona colleges is the Arizona Commerce Authority, a state agency responsible for advancing industry and business investment in the state.

> ➢ **Ohio:** The Ohio-based colleges in this study are in different areas of the state: one in Northern Ohio outside of Akron and near Cleveland that spans both urban and rural areas (Lorain); one in Columbus with multiple campuses across the urban area (Columbus State); and one between Dayton and Columbus that includes more rural areas (Clark State). Manufacturing is thriving in Columbus and across the state generally, even if the industry is smaller today than its historical footprint and perceived as declining. All three colleges contribute to statewide programs and networks upon which they rely to inform regional strategy and tactics.

> ➢ **Florida:** The case study college in Florida was in Daytona, which includes both urban and rural areas. The college's relationships with the state and an ATE-funded center were significant to the programs we observed, particularly the introduction of a Federation for Advanced Manufacturing Education (FAME) program sponsored by local manufacturers.

> ➢ **Wisconsin:** The case study college in Wisconsin was in Racine and served both urban and rural areas between Milwaukee and Chicago. The statewide community college system and the long history of manufacturing in the region shaped local action.

Regional Manufacturing Sectors

Each site was situated within different industry landscapes with local manufacturing sectors at different stages of growth; this was true both across states and across sites within the same state. Notwithstanding this variation, all programs investigated were designed to support their respective manufacturing industries by providing a skilled workforce of technicians tailored to regional needs. In other words, all programs in this study were engaged in a sector-strategy framework. Accordingly, the insights put forward in this report are most useful for conceptualizing the community college role in economic development as it pertains to sector strategies—specifically, manufacturing-sector strategies—though it may lend insight into other arenas of economic development as well.

In Arizona, the Phoenix metro region's economy is booming, with the high-tech manufacturing industry moving into the area to build upon its existing semiconductor R&D and manufacturing presence. Thus, the Maricopa Community Colleges, including Estrella Mountain and Mesa, enjoy the benefit of a thriving manufacturing sector and face the urgent challenge of providing enough trained workers to support the fast-growing industry. Tucson, while a growing metropolitan region, is not growing at the same rate as Phoenix, and manufacturing is not historically one of the largest industries in the region. Pima, which is based in Tucson, works with existing industry to build relationships and provide customized programming for existing employer partners, training technicians primarily for entry-level jobs.

Ohio sites are also diverse in terms of manufacturing capacity. Lorain County is in the Cleveland metro area, which has a declining population and an economy facing several challenges. Lorain Community College plays a vital role in economic development, educating and training students and developing partnerships not simply across the local region but also across the state. Columbus is a growing city experiencing an influx of industry and an increasing population. Historically, Columbus State has partnered closely with Honda, and the college is currently one of the leaders in preparing training for transformative investments in Ohio by Intel. Clark State, located just 45 minutes outside Columbus, is also seeing growth in its immediate surrounding region. This growth is not happening at the same rate as it is in Columbus, however, and the manufacturing jobs in the region are not as high-tech or high-paying as some of their counterparts in the other regions of Ohio explored in this study.

Two sites selected outside of Arizona and Ohio represent very different manufacturing ecosystems. The site in Florida is in the Daytona region, where manufacturing is not historically the largest industry but is rapidly growing. Technicians are needed there to bolster an emerging high-tech manufacturing sector. In response to this need, Daytona State developed its FAME program in partnership with the local manufacturers' association to train technicians for industry. The site in Wisconsin, on the other hand, has a long and robust history of manufacturing and technician education. Gateway Technical College has steadily invested in its manufacturing programs over the years since its founding in the early twentieth century, helping the region weather the ups and downs of domestic and global manufacturing trends.

Other Important Context

Deeper investigation of the state governance landscapes invoked here and in which community colleges operate is extremely important but remains outside of the scope of this report. (See Appendix II for more detail on colleges' funding streams, for example.) The focus of the HII project is on the program-level activities and strategies of community colleges executed in partnership with employers and regional economic development organizations. However, our findings have identified a critical need for future research on the role of state-level policy and programming in determining the capacity of community colleges for regional and strategic engagement with economic development. Community colleges, as publicly funded institutions, are significantly influenced by the approach of their respective state governments. As this report demonstrates, case study colleges in Arizona and Ohio reaped enormous benefits from strategic, large-scale, and well-funded efforts by their state-level entities to support workforce development infrastructure and community colleges as workforce development institutions. Specifically, those colleges' capacity to institutionalize their coordination and collaboration efforts, as well as their relationships with industry and regional economic development players, were especially shaped by state support, or lack thereof.

It is also important to keep in mind that there is a long history of community college contributions to economic development, including some community college systems established with missions to support industrial development. We argue in this report that the character of that function and its centrality in economic development strategies are changing. Community colleges have long been relied upon by American policymakers as a unique vehicle for workforce training efforts, especially in moments of national transition or crisis. Though they had their start in the very late nineteenth century, community colleges proliferated at a national level in the middle of the twentieth century with the GI Bill, which dedicated federal funds to retraining veterans, primarily through community colleges. Decades later, community colleges would be central to the federal response to the Great Recession through TAACCCT, which funded colleges to help unemployed adult workers transition into high-demand jobs. Community colleges have been integral to the administration of unionized, registered apprenticeship programs over the course of the twentieth century, and as unions waned through the late twentieth century, community colleges became the primary vehicle for meeting customized business training needs outside of employer-provided training, especially during national economic downturns. In both contexts, manufacturing firms were particularly close partners of community colleges and nationally at scale.[1] This is important to remember if attempting to extrapolate the findings of this report for application to other industries.

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[1] Jacobs, J., Worth, J. (March 2019, No. 107). The Evolving Mission of Workforce Development in the Community College. Community College Research Center Working Paper. https://ccrc.tc.columbia.edu/publications/evolving-mission-workforce-development-community-college.html

Ultimately, the relationships between workforce development and economic development, and between community colleges and economic development leaders, continue to grow more intertwined and to demand increasing attention. As workers' skills and human capital strategies have become central to economic development goals—and as firms have had to coordinate more systematically to compete globally as sectors—regional labor markets have taken on new strategic importance. Community colleges are unique institutional linkages between labor supply and labor demand in the American context, and they are increasingly pivotal to the generation of competitive, skilled labor markets for fast-evolving, globally competitive industries.

Focal Programs of Study

Once the research team selected regions and colleges, we reviewed all relevant advanced manufacturing–related associate degree programs and selected the two at each college that served the largest number of students. For all three Arizona schools, we studied the statewide automated industrial technology (AIT) program. The AIT program is an advanced manufacturing technician training program designed to unify state curricula and help manufacturers moving into the state find the technicians they need. Our focal program areas in Ohio were manufacturing engineering technology and industrial technology at Clark State, electro-mechanical engineering technology and electronic engineering technology at Columbus State, and microelectronic manufacturing (MEMS) and automation engineering at Lorain. We focused on engineering technology and computer engineering technology at Daytona State and advanced manufacturing technology and welding at Gateway Technical College. (See Appendix I for more details on the programs of focus.)

Data Collection and Analysis

College Data. Case studies consisted of two rounds of in-depth, semi-structured interviews with college administrators, faculty, and staff identified in collaboration with the college. Respondents were selected based on their knowledge of the programs of focus. The first round of interviews was conducted online via Zoom between April and November 2022 and was followed by a round of in-person site visits between May and October 2023. Follow-up interviews were conducted online via Zoom through May 2024 and were supplemented by interviews and additional site visits with employer partners and with regional economic development partners identified by the colleges. College administrator, faculty, and staff interviews were coded, and concepts were developed to capture (1) drivers of economic development, (2) structures for economic development, (3) activities for economic development, and (4) contributions to or outcomes of economic development. Memos and tables were produced to analyze dynamics within colleges, across partners, and within regions. Table 1 illustrates the variety of roles held by college administrators, faculty, and staff who were interviewed for this study.

Table 1: College Faculty and Staff Interviewed, by Role

Respondent Type	Total	Total Colleges Included
Senior leadership: Directors, deans, chairs, VPs, presidents, provosts	28	8
Faculty and instructors	20	8
Program/Center-related roles	7	4
Student advisors	12	8
Business advisors	6	5
Total	73	8*

*Total is not the sum of the column because more than one type of respondent was interviewed at each college.
*In addition, five students were interviewed from four schools.

Employer Partner Data. Additionally, we spoke with at least two employer partners at each site, resulting in twenty total employer partner interviews. Table 2 presents the characteristics of the employer sample at each college site. During interviews, we inquired about employer partners' perceptions of their relationships with community colleges and their programs, including why and how these relationships were developed and how employers individually or collectively viewed and contributed to the development of programming, curriculum, and instruction related to technician education. Finally, we asked how employers viewed students and workers who were trained by college-affiliated technician programs and whether these students contributed to firm productivity and innovation.

Table 2: Context and Characteristics of Employers, by College Site

College	State-Service Area	Number of Employees Interviewed	Industry of Employers Interviewed
Pima County Community College	AZ – Greater Tucson	3	Defense Construction Metal
Mesa Community College	AZ – Greater Phoenix	4	Semiconductors Aerospace Metal
Estrella Mountain Community College	AZ – Greater Phoenix	2	Electricity Natural gas
Columbus State Community College	OH – Greater Columbus	2	Electronics Incubation/Prototyping
Lorain County Community College	OH – Northeast Ohio	2	Steel/Metal Electricity products
Clark State College	OH – Greater Springfield/Dayton	2	Steel/Metal Electricity products
Daytona State College	FL – Central FL/Volusia County	3	Labs and facilities Defense Boats
Gateway Technical College	WI – Southern WI/Racine County	2	Appliances Razors

Regional Economic Development Partner Data. Finally, and in addition to engaging employers, we conducted interviews with and administered surveys in January 2024 to regional economic development partners working with the selected college programs in order to gain a comprehensive view of all three perspectives we believed to be crucial to processes of economic development (the colleges themselves, their employer partners, and their regional economic development partners). These regional economic development partners were chosen with the help of leaders from the case study colleges and included leadership of regional chambers of commerce, regional manufacturers' associations, county-level departments of education and workforce development, and regional economic development organizations, among other types of partners. Table 3 shows the diversity of regional economic development partners working with the eight case study colleges and how many were formally engaged in this study via survey or interview.

Ultimately, we conducted eleven in-depth, semi-structured interviews with regional economic development partners of the colleges and surveyed 84 of them. We received 31 survey responses, resulting in a response rate of 37 percent. A total of 32 regional economic development partners were engaged through surveys and interviews combined.

Table 3: Regional Economic Development Partners Identified and Engaged, by Organization Type

Partner Type	Number of Partners Engaged via Survey or Interview	Number of Partners Identified
Chambers of commerce	5	10
Economic development organizations	7	16
Higher education organizations	3	6
K-12 organizations	2	9
Workforce development organizations	9	18
Industry-affiliated partners	3	16
Community-based organizations	2	7
Unions	1	3
	32	85

Interviews with regional economic development partners focused on their approach to economic development in their region and their perceptions of and relationships with community colleges. The overarching goal was to gain an understanding of the economic development ecosystems in which the community colleges participate. Researchers analyzed regional economic development partners' interview and survey responses together to better contextualize data from community college faculty and staff regarding university partnerships, contributions to economic development, and regional engagement.

Definitions

As a final point of clarity, the following definitions are for terms or entities referenced throughout this report.

➤ **NSF**: The US National Science Foundation (NSF) is an independent federal agency that supports science and engineering in all 50 states and US territories. The NSF was established in 1950 by Congress to promote the progress of science; advance the national health, prosperity, and welfare; and secure the national defense.

➤ **ATE**: The Advanced Technological Education (ATE) program, funded by the NSF, supports the education of technicians for the high-technology fields that drive our nation's economy. The program involves partnerships between academic institutions (i.e., grades 7–12, higher education), industry, and economic development agencies to promote improvement in the education of science and engineering technicians.

➤ **Community college**: Community colleges are affordable public colleges, funded by tax dollars, that offer two-year programs leading to Associate of Arts (AA) or Associate of Science (AS) degrees. These colleges also often have technical and vocational programs with close links to secondary/high schools, community groups, and employers in the local community. In some states, community colleges may be commonly called 'state colleges' (e.g., Florida). For the purposes of this report, we use the term community college.

➤ **Technician education for advanced technologies**: Technical education supports the education of the skilled technical workforce at the undergraduate and secondary school levels. This workforce includes individuals who use a high level of science and engineering skills in their jobs but do not hold a baccalaureate degree. Fields of technology generally supported by technical education include, but are not limited to, advanced manufacturing technologies, agricultural and biotechnologies, energy and environmental technologies, engineering technologies, information technologies, micro- and nanotechnologies, security technologies, geospatial technologies, and autonomous technologies.

Chapter 1: College Activities and Strategies

Introduction

The college administrators, faculty, and staff of the eight case study colleges engage in a range of activities that may contribute to regional economic development. In this chapter, we catalogue those activities using the conceptual model developed in the Rutgers Hidden Innovation Infrastructure (HII) concept paper, The Community College Role in Economic Development: A Conceptual Model. (See Figure 1.1.) Accordingly, we analyze the colleges' economic development activities across the model's three activity types, or levels of engagement: education and training activities at the level of the college; business support activities at the level of the firm; and regional engagement activities at the level of the region. We then examine the internal and external dynamics that shape each college's activity footprint, including the college's extensive partnership work.

Figure 1.1. HII Conceptual Model
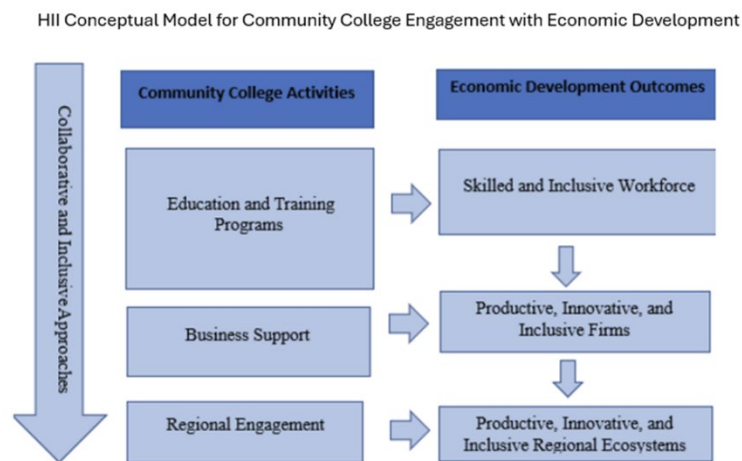
Source: Van Noy, M., Weaver, A., Forbes, A., & Bragg, D. (2023). The community college role in economic development: A conceptual model. Education and Employment Research Center. Rutgers University.

Main Findings

We found that many economic development activities of the eight community colleges extended from the foundational curricula of their technician education programs. The community colleges' technician education programming demanded that their personnel engage with multiple regional actors. Personnel variously focused on improving student enrollment and persistence, providing business services to support local employers, or engaging industry leaders and other ecosystem actors at the regional level. Often, these objectives overlapped in

the context of program design and administration, and staff engaged different foci at different points in time depending on the administrative structure of the program, partnering with a variety of external ecosystem actors for whom one type of activity was a priority.

Notably, we found that the words "productive," "innovative," and "inclusive," used in the initial conceptual model, were rarely used by the professional educators with whom we spoke. Instead, they talked about concrete activities that led to specific results for individual students, businesses, and workers. When they described longer-term outcomes of their work, they primarily talked about creating healthier, more resilient, and more inclusive regional economies.

Insights from this chapter include:

➢ **Community college manufacturing-related programs laid the groundwork for a variety of activities that may have contributed to economic development.** At the eight community colleges under study, degree and certificate programs enabled responsive and effective engagement with employers and with regional industry more broadly.

➢ **Education and training, business support, and regional engagement were linked together,** with education and training activities providing an important anchor for the other two types of activities. Moreover, industry-oriented training programs provided a unique vehicle for the strategic blending of activities and helped to integrate community colleges into their regional economic development ecosystems.

➢ **Work-based learning was a critical education and training activity** observed across the colleges in different forms; work-based learning uniquely integrated the three economic development activity types in a way that served students, employers, and the region.

➢ **The greatest point of variance across the colleges was the level of involvement of senior leadership** in technician education programs. The senior leadership of some colleges was very involved in at least certain elements of the programs, whereas that of others was not.

➢ **Employer partners were foundational to successful technician education programs.** Partnerships with manufacturing-specific employer associations presented unique opportunities for colleges to serve the local manufacturing industry at the regional level and to respond to manufacturing-specific challenges.

➢ **Partnerships with other community colleges were among the most important** for the case study colleges, and they helped the colleges respond to statewide as well as more local labor demands. State capacity and convening power played significant roles in facilitating community college collaboration.

➢ **Inclusion was discussed as a priority across the colleges,** although how it was defined and implemented varied significantly. Regardless of the differences across the cases, community-based organizations were important partners to these colleges, especially regarding outreach and diversifying their applicant pools.

The structure of this chapter is as follows: First we analyze the activities of the colleges using the conceptual model and its three activity types; then, we examine the internal and external dynamics of the colleges, which shape their activity-strategy footprints. Regarding internal dynamics, we explore the administrative structures of the programs under study. Regarding external dynamics, we investigate the colleges' partnerships with employers and employer associations, other economic development ecosystem actors, and other community colleges. We conclude with a discussion of how colleges strategized around inclusion.

The Regional Economic Development Activities of Community Colleges

Table 1.1 reflects all of the economic development contributions cataloged across the colleges, by activity type and then in order of prevalence of the activity among the colleges. (See Appendix III for more detail.) Those activities in Table 1.1 with a count of eight schools were implemented by all eight case study colleges. Unsurprisingly, most of the colleges' economic development contributions are categorized as education and training activities (17 total activities), with business support and regional engagement categories including 5 and 6 activities, respectively. Additionally, many of the most common economic development–related activities implemented by all of the colleges (those activities with counts of 8) were education and training activities. The most common business support activity among the colleges was incumbent worker/customized training, and the most common regional engagement activity among the colleges was participation in local economic planning/policymaking. More detail on the most common economic development–related activities by activity type follows below.

Table 1.1 Activities Checklist, by Activity Type and Prevalence Among Colleges

HII Activities Checklist	Count of Schools
EDUCATION AND TRAINING ACTIVITIES	
Hands-on learning	8
Work-based learning	8
Apprenticeships	5
Learn-and-earn model	4
Paid internships/co-ops as program requirements	2
Grants for equipment	8
Dual enrollment	8
BA pathways (some type)	8
Updated curriculum aligned with jobs	8
Regionally aligned and developed program/Courses & programs aligned with local workforce needs	8
Industry advisory boards	8
School/program job fairs and related events, program reverse job fairs, or online matching with employers	8
Credit for prior learning/Prior learning assessments	7
Short-term (less than one year) training/Bootcamp style	6
National credentialing/Industry certification	6
Club/Maker space	4
Hiring majority of faculty for a program from industry	4
Visits with employer on-site	4
Community job fair/Expo	2
Noncredit-to-credit pathways*	1
BUSINESS SUPPORT	
Incumbent worker/Customized training	8
Establishment of facilities for use by local companies	5
Technology transfer & applied research	5
Small business incubator & assistance	4
Entrepreneurship training	3
REGIONAL ENGAGEMENTS	
Participating in local economic planning/policymaking	8
Assisting in attracting employers to the region	7
Leading/coordinating other colleges on industry needs	4
Lead regional organizations or convene regional stakeholders	4
Participate in state/regional boards	3
Conducting economic scans	1

*Given the evolving nature of the noncredit space, more colleges may have noncredit-to-credit pathways than is reflected in this count.

Activity Type 1: Education and Training Activities

Education and Training Activities Implemented by All Case Study Colleges
The education and training activities that all of the colleges implement are defined in Table 1.2. We note whether they focused on students, including their enrollment and completion goals, provided direct support to businesses, or served industry demand at a regional level.

Table 1.2 Education and Training Activities All Case Study Colleges Implement

Category and Activity	Definition
ENROLLMENT AND COMPLETION	
Dual enrollment	Community college and high school staff align curricula and formalize agreements so that high school students can earn both college and high school credit at the same time.
BA pathway	Community college offers a Bachelor's degree program or has a transfer agreement with a four-year school so that associate degree graduates may apply their program credits toward a Bachelor's degree.
ALIGNMENT WITH INDUSTRY VIA BUSINESS SUPPORT	
Work-based learning	College programs have requirements or options for students to work at employer sites under employer supervision while they are enrolled in programs of study.
Program-specific job fairs	Colleges provide opportunities for students in technical education programs to engage with potential employers through traditional job fairs, 'reverse' job fairs where students present their work, or via online matching platforms.
Grants for equipment	College faculty and staff receive grants specifically intended for acquiring or updating manufacturing equipment.
ALIGNMENT WITH REGIONAL INDUSTRY	
Hands-on learning opportunities	Colleges/program instructors teach skills for using manufacturing equipment or engaging in activities that require hands-on work.
Curriculum aligned with local skill demand	College faculty and staff update curricula to teach skills that employers identify as needed for their workforce.
Industry advisory boards	Program- or college-level advisory boards consisting of college faculty and staff as well as employers provide guidance for program development and implementation.

Some of the education and training activities considered important to economic development did not require direct employer or industry action and were instead the purview of the college and its regional educational partners, including local high schools and universities. These included **dual enrollment programs,** which connect high school students to college coursework and college credit, as well as **articulated pathways or transfer**

agreements between two-year and four-year degree programs, which connect community college students to further education and bachelor's degree attainment.

Other education and training activities focused on aligning the interests of students and employers over the medium to long term by cultivating the regional talent pipeline. With activities like **hands-on learning** and **industry-relevant curricula**, students learned foundational manufacturing skills in demand by regional employers and applied them in the classroom as well as on the job site. Accordingly, college-hosted **industry advisory boards** met regularly to ensure alignment between program elements like these and regional business needs.

Some education and training activities supported the alignment of training with industry while providing an immediate and direct benefit to the region's individual businesses. For example, some schools that **used industry-grade equipment** for their training offered equipment access to local businesses as well; firms leveraged that access to experiment with new technologies, among other purposes. Employer-sponsored **work-based learning programming** was another illustrative example of an education and training activity that directly benefited regional employers. While all employers hiring from programs that incorporate work-based learning stand to gain workers trained in regionally relevant work contexts and technologies, some proactively sponsored, engaged, and trained their future employees in partnership with community colleges. In many cases, this resulted in more efficient hiring processes for those employers and often led to higher retention rates as well.

Integrating work-based learning into college degree and certificate programs had an outsized impact on students, workers, and employers, and those positive effects often extended to the region writ large. It gave students an opportunity to gain direct experience with a regional employer in the course of their study, providing a period during which both the student and employer could test for a good fit. It allowed regional employers to integrate the instruction required to meet their needs directly into curricula, and it often brought multiple employers together in the context of a technician education program as representatives of the regional industry footprint.

While all colleges in this study provided work-based learning opportunities as part of their curricula, those opportunities were structured differently across the schools: some programs required earn-and-learn components, others integrated paid internships and co-ops, and still others offered apprenticeships. Earn-and-learn models have grown in popularity, as they allow students to take classes while working at employer sites to earn income. Co-ops and internships may take place at employer sites alongside traditional, classroom-based coursework, or during summers or other times when students are not taking classes. Registered apprenticeships, which are formalized through the US Department of Labor (US DOL) or state apprenticeship agency, were offered at some of the case study colleges. These programs required more formal employer sponsorship through contractual employment by an employer or an intermediary, and the program design had to meet certain industry standards. Employers also worked with case study colleges to design and sustain apprenticeship-like programs that were not formally recognized by the US DOL but had many of the same features.

In addition to whatever exposure to regional employers students gained as part of the curricula, college faculty and staff provided other kinds of opportunities for students and employers to interact and learn about each other as students prepared to graduate and seek employment. Some programs held traditional **job fairs** for students where employers described their companies and employment opportunities. Representatives from one college described an expo-type event that was open to students as well as community members. Conversely, at **reverse job fairs,** students presented their work to employers. Colleges that supported online matching offered web-based resources that invited students to enter information about their skills into a database, then matched them with the needs of particular employers.

Variance: Education and Training Activities Implemented by Some Case Study Colleges

Activities that some, but not all, of the colleges in this study implemented required significant administrative capacity that not all colleges possessed. For example, at some colleges, administrators provided clear institutional **pathways from noncredit education to credit,** which allowed students to access credit-bearing education and continue toward higher credentials. Administrators were also responsible for establishing **prior learning assessments** to facilitate student enrollment and expand access to credentials, especially for nontraditional students who may have acquired significant knowledge through work experiences.

Colleges provided students with academic counselors, support services, and scholarships or financial assistance to varying degrees. These student support structures can help sustain students and workers through manufacturing programs to employment, ensuring more students have access to manufacturing careers. Staff at some community colleges recruited and trained hard-to-reach populations with the help of grant-funded initiatives and by working with community-based organizations and government agencies. For example, there have been long-standing efforts among technician education programming staff to recruit women for manufacturing careers; we found that engaging women for these programs still requires dedicated outreach and support. Several representatives of the colleges in this study discussed targeted outreach efforts to recruit women for their programs that met with varying levels of success. In some cases, **short-term boot camps** were structured specifically to address the scheduling conflicts most frequently faced by women.

There were other noteworthy points of variance among the colleges. Some colleges offered clubs **or maker spaces** where students, and in some cases community members, could use equipment, technology, and materials to create products. Faculty and staff at some colleges embedded **industry certifications** into their programs, while others aligned their programs with industry needs without offering the certifications themselves. These differences demonstrate that colleges employ a range of strategies for preparing students to meet the workforce needs of regional employers. How colleges in the study structured these programs, including their administrative capacity, in part determined what economic development activities they could implement through them, enhancing their programs and contributing to the regional economy.

Activity Type 2: Business Support Activities

The most common business support activity we observed across the colleges in our study was training for current employees of regional manufacturing companies; Table 1.3 defines this activity.

Table 1.3. Business Support Activity Occurring Most Commonly Across Colleges

Activity	Definition
Incumbent worker/Customized training	College faculty train existing employees in programs customized for their employer.

Customized training for incumbent employees usually entails tailoring a curriculum to a particular company's needs. While this activity is related to education and training, the employer is the primary client. Employers may finance the training with their own revenue or access funds from government grants or other sources; employer partners of the colleges in this study took advantage of state-funded subsidies for incumbent worker training. Though a form of direct business support, this activity can be linked to student support as well, depending on how the customized training is structured. For example, faculty at case study colleges provided customized training for employees through both noncredit and credit-bearing programs. Some colleges had processes to convert noncredit training to college credit if workers were interested in continuing their education. Additionally, the way schools approached providing this type of business support varied. In some cases, faculty built relationships with businesses and taught courses for incumbent workers. In others, employers initiated and contracted with colleges to train their existing workforce around a particular need. Ultimately, students and workers benefited from these college-employer collaborations around incumbent worker training.

College respondents described engaging in some additional business support activities that were important for their overall employer engagement; college administrators, faculty, and employers all played roles in business services. Three colleges had **business incubators.** Several colleges allowed employers to **access their facilities** and use their equipment. Some colleges engaged in **applied research** in partnership with employers.

Activity Type 3: Regional Engagement Activities

The regional engagement activity that all case study colleges implemented was participating in local economic planning and policymaking; additionally, all colleges but one assisted in the attraction of firms to their regions. (See Table 1.4 for the definitions of these two most common regional engagement activities.)

Table 1.4. Regional Engagement Activities Occurring Most Commonly Across Colleges

Activity	Definition
Participating in local economic planning/policymaking	College faculty or staff participating in activities with actors external to the college, with economic planning or policymaking as a goal.
Assisting in attracting employers to the region	College faculty or staff working with organizations or associations to demonstrate the benefits of their locality or region to employers who might open facilities in the area.

All colleges indicated they participated in **local economic planning or policymaking,** though that participation varied in form. Colleges also noted their collaborative efforts with economic development organizations and chambers of commerce to **engage with potential employers** and discuss regional advantages, including a skilled regional manufacturing workforce and the infrastructure the colleges were building to cultivate it. College representatives emphasized that businesses increasingly consider talent availability and training infrastructure to be important factors when deciding whether to move into or expand in an area.

Internal Dynamics Shaping Colleges' Activity Footprint

We explored the ways that college organized these activities internally. We focused on understanding the range of potential structures within each college that support their execution of this range of activities.

The importance of college leadership roles.

Understanding which people on community college campuses are involved in the work of partnering with employers and other economic development actors is important for understanding how colleges operationalize their contributions to economic development in practice. College faculty and staff explained how their respective programs met the needs of students, local employers, and the broader regional industry through different bureaucratic configurations**. We found wide variation in how and where key actors were situated within colleges to meet the evolving needs of manufacturers. That variation corresponded in part to differences in industrial settings, manufacturing ecosystems, college leadership, and college funding.**

We worked with liaisons at each college to identify actors knowledgeable about our manufacturing programs of focus. **Those actors spanned roles as senior leaders, faculty and instructors, managers of grants and centers, institutional research and planning administrators, student and business advisors, and students.** Each of these actors brought a different perspective on where their work was situated within their institution and how that work was connected to students and their families, employers, communities, and regional partners. We categorize these actors according to their roles to better understand how the work of connecting technician training to economic development occurs within colleges. (See Table 1.5 and Appendix IV for more information.)

Table 1.5. Roles Involved in Technician Education Programs, by College

College	Senior Administrators	Faculty or Instructors	Program / Center-Related Roles	Student Advisors	Business Advisors	Total
Clark	6	4	1	1	1	13
Columbus	2	2	1	2	1	8
Daytona	2	3	0	2	1	8
Estrella	2	2	0	2	0	6
Gateway	5	2	0	1	0	8
Lorain	6	2	4	1	2	15
Mesa	1	4	1	2	1	9
Pima	4	1	0	1	0	6
All colleges, TOTAL	28	20	7	12	6	73*

* Five students not employed by the colleges were also interviewed to inform our understanding of the college perspective. These included two from Pima and one each from Lorain, Daytona, and Gateway.

Colleges varied in how they engaged with industries and regional manufacturing ecosystems, most notably in terms of the attention paid by key senior leaders to overseeing general workforce programming—and specifically manufacturing programs—relative to other parts of the colleges. For example, senior leaders at Arizona colleges had roles focused specifically on manufacturing and workforce programs. In contrast, the responsibilities of the relevant senior leaders at one Ohio college spanned a wide range of departments and administrative offices, including, for example, the oversight of academic affairs, programs, assessments, institutional development, and workforce programs. Also, the extent to which program coordination relied on adjunct faculty or was performed by full-time faculty varied widely.

The different job titles of similar actors sometimes reflected the ways in which colleges attempted to frame the provision of services for particular audiences. For example, with regard to student services for program participants, we found a program-specific advisor in one school but general academic advisors in most others. A unique role identified at one school, an executive-in-residence position, was related to the provision of business services broadly, including elevated engagement with the regional business community.

We observed the most variation among roles connected to special initiatives or centers, which were often the recipients of dedicated funding streams. Clark State received a grant to train specific populations, and a dedicated project manager was supported by that grant. Both Mesa and Lorain developed specialized workforce-related functions within parts of their colleges with specifically dedicated funds. Mesa's Arizona Advanced Manufacturing Institute (AzAMI) employed a director and staff to provide services for students and employers to connect and build a regional manufacturing workforce. The Ohio TechNet, which is housed at Lorain, had a part-time director and project manager who connected community colleges with each other in support of their synergistic workforce efforts, providing related resources and grant-management training.

Some programs involved systematic coordination with actors from within the college but outside of the technician education programs. For example, some colleges anchored more comprehensive industry-relevant programs within existing training offerings taught by departmental faculty. Daytona State's FAME program incorporated elements of mechatronics curricula used and taught by other non-industry-related programs within the college.

External Dynamics Shaping Colleges' Activity Footprint

In exploring the external dynamics that shape the colleges' activity footprints, we focused on the colleges' partnerships. Within manufacturing programs, partnerships with employers are especially important to colleges' missions to serve students. In this section, we extensively elaborate on colleges' employer-partnership activities, then follow this examination with a discussion of colleges' partnerships with other economic development ecosystem actors and, finally, with other community colleges.

Case study colleges partnered with a diverse array of actors in their respective economic development ecosystems. Table 1.6 shows the total number of partners engaged by type.

Table 1.6. Total Partners of Case Study Colleges, by Type

Partner Type	Number of Partners Engaged via Survey or Interview	Number of Partners Identified
Employers	20	20
Workforce development organizations	9	18
Economic development organizations	7	16
Chambers	5	10
HE organizations	3	6
Industry-affiliated partners	3	16
K-12 organizations	2	9
Community-based organizations	2	7
Unions	1	3
TOTAL	32	85

Partnering with employers & employer associations

Optimally, colleges collaborated with multiple employers in a coordinated ecosystem-building approach via initiatives or programs that were regional in scope. For example, Columbus State's President's Workforce Advisory Council brought together the regional manufacturing industry across its local subfields. Columbus State also had a long-standing collaborative relationship with Honda that involved developing programs to meet the company's workforce needs. That relationship extended to the wider ecosystem and the broader regional manufacturing

sector; as a result of its original partnership with Honda, the college now places students in several regional manufacturing companies to gain work experience through its Modern Manufacturing Work Study (MMWS) program. This trend of a strong relationship with a particular employer leading to a wider, ecosystem-level effort was not unique to Columbus State. Across the sample, strong, long-standing relationships between colleges and regional employers, especially large regional employers, tended to strengthen the whole ecosystem's collective approach to a regional talent pipeline.

Respondents at some schools described coordinating with actors in the growing national semiconductor industry to develop programs to meet their evolving workforce needs. Both Lorain and Columbus State were leading grants from Intel to prepare for the company's move into Ohio, developing training to meet specific skill requirements. Faculty and staff at both schools explained that, while their institutions' existing curricula already incorporated relevant training, they were developing new, targeted programmatic elements through concerted engagement with their partners in the semiconductor industry. Moreover, community colleges in Ohio formed a consortium to respond to Intel's request for a curriculum aligned with microelectronics manufacturing. The consortium built much of the new curriculum from existing offerings so that new programs would be strongly anchored, resourced, and institutionalized. Similarly, Arizona colleges engaged with the semiconductor industry's needs through a coordinated response that included the development of short-term training to meet immediate needs.

How colleges translated employers' workforce needs into responsive technical education programmatic structures varied widely. Recognizing the importance of meeting urgent industry demand for skilled workers, some faculty and staff respondents described structuring their programs with technical skills training front-loaded, allowing students to apply their skills in the workforce as quickly as possible—a benefit to both students and employers. Some colleges deployed multiple, overlapping programmatic structures at once. For example, Clark State incorporated stackable shorter-term certificates; aligned programs with industry-relevant certifications; and embedded certifications directly within some programs. Gateway implemented a similar practice of embedding industry certifications into programs. At Mesa, students earned both technical and employability skills through AzAMI-specific programs that embed the Arizona Career Readiness Credential within both short- and long-term program offerings. To support industry-relevant training, all three of our Arizona case study colleges employed adjuncts and faculty with direct industry experience to teach students relevant skills.

Colleges partnered with employers in important indirect ways, including through strategic equipment investments and curricular upgrades. For example, colleges in our study sought to meet industry needs by maintaining up-to-date equipment with industry-wide appeal, generally avoiding equipment targeted at a limited set of employers. Clark State faculty described training students on a range of equipment from a variety of regional manufacturers, which helped students develop adaptable troubleshooting and problem-solving skills necessary for not only

operating but also maintaining equipment. At Lorain, where faculty trained students on industry-grade equipment, the lead MEMS instructor recounted discrete examples of students contributing to company efficiencies by drawing from their program's training.

Case study colleges responded to industry leadership by regularly updating their training. For example, Gateway developed and incorporated Industry 4.0 training into their curricula to meet the needs of both global companies that were relatively new to the area as well as regional companies with long histories of working with the college. Industry 4.0 is now part of the curricula of Gateway's associate degrees programs in advanced manufacturing technology and electrical engineering technology; technical diplomas for CNC Production Technicians, CNC programmers, and electrical maintenance technicians; and certificates for advanced manufacturing specialists and mechanical maintenance technicians.

Finally, employer associations were key strategic partners to colleges in coordinating at the regional level with local businesses and over the medium to long term. Employer associations helped coordinate the business landscape so that industry actors could articulate collective needs and engage the regional workforce development infrastructure, including community colleges, in a strategic way. Chambers of commerce and manufacturing associations were two of the most common and most important types of employer associations that served as partners to the colleges in this study.

All our case study colleges had relationships with chambers of commerce that were targeted at creating mutually beneficial linkages between colleges and employers. For example, a Daytona State representative described working with chambers of commerce to connect with employers who were interested in hiring students. In Ohio, Clark State representatives worked with local chambers of commerce to partner on activities such as organizing events for manufacturers to discuss their workforce needs, and Lorain staff regularly attended chambers of commerce meetings to stay connected to regional industry players. In Arizona, Estrella Mountain representatives worked with their regional chambers of commerce to learn about workforce needs, and Pima representatives cited chambers of commerce as one of the many types of partners helping them remain aligned with changes in manufacturers' skill demands.

Manufacturing associations represented a unique partnership opportunity for community colleges that strengthened their industry-specific employer engagement and enhanced colleges' understanding of manufacturing-specific needs. In Arizona, Pima was highly involved with the Southern Arizona Manufacturing Partnership. The Ohio Manufacturing Association was a key partner for the Ohio community colleges, and Clark State collaborated with the more local Dayton Regional Manufacturing Association. In Florida, the Volusia Manufacturing Association was instrumental in connecting Daytona State with employers for the college's FAME program. FAME is a national program adopted by community colleges in partnership with local industry. In

Daytona, it took the shape of an innovative two-year program sponsored by area manufacturers to recruit, hire, and retain talented workers; it recruited most of its students directly from local high schools in Daytona into advanced technical roles at regionally based companies. All students in this cohort model worked part-time at one of the program's employer partners and simultaneously attended classes substantively aligned with that work. Daytona State students in the FAME program gained work experience with their employer sponsors, and other associate degree students gained valuable exposure to regional work experience through the program. All or nearly all associate degree students at Daytona State who wanted local jobs in manufacturing upon graduation obtained gainful employment. The program was an illustrative example of the benefits borne of coordination between colleges and manufacturing ecosystems; Daytona State's FAME program quickly contributed to its regional economic development ecosystem, helping the regional economy overcome basic coordination problems that often act as parameters on industry growth and innovation.

Partnering with other economic development ecosystem actors.

In administering their technician education programs, colleges partnered with other types of organizations, including formal regional economic development organizations, high schools, vocational schools, universities, government agencies, and community-based organizations. Faculty and staff illustrated how partners amplified their programs' impacts, describing who the programs can reach, on what timeline, and what outcomes were achieved.

Ongoing collaborations with economic development organizations helped college staff stay updated on local labor market conditions; better orient their students to labor market opportunities; and maintain the visibility of their programs across their regions. These collaborations often focused on specific programs of the colleges, helping to connect and align them with regional needs. One of the strategies that some colleges employed with the help of local economic development organizations, and which served both their students and their regional economies, was educating students on career options across the region and their associated employment opportunities and wage levels. For example, working with the economic development organization Team Neo, Lorain implemented Career By Design, an initiative to educate students about expected wages and projected labor market dynamics within their region as they make decisions about the college's programmatic offerings. Economic development organizations were key partners in Arizona as well, with some taking leadership roles in the stewardship of the AIT program and directly collaborating with AzAMI. Estrella Mountain benefited from strong connections to economic development entities such as Westmarc, and Pima collaborated with economic development organizations to attract employers to the area.

Community colleges' collaborations extended to government agencies and community-based organizations. Faculty and staff at both Clark State and Lorain in Ohio referenced partnerships with OhioMeansJobs, a state-level

workforce development organization. Clark State was also working directly with Ohio Jobs and Family Services to access data for outcomes tracking. In Arizona, Pima had extensive relationships with public-sector agencies, including those engaged in workforce development and the delivery of other support services. Relatedly, community-based organizations served as important linkages for case study colleges to their surrounding communities and helped colleges to engage specific populations. For example, Gateway partnered with correctional facilities to provide training, and Clark State worked with both a women's organization and an organization for people with disabilities to attract a more diverse applicant pool.

Community colleges partnered with educational institutions spanning from K–12 schools to universities. Faculty and staff at the case study colleges worked with middle schools and high schools to build pipelines of students interested in manufacturing by visiting classrooms and offering students opportunities to learn about their programs, technological equipment, and related facilities. For high school students specifically, colleges provided dual enrollment opportunities. Community colleges similarly partnered with universities, collaborating both programmatically on elements of their technician education programs and institutionally on the creation of clear pathways for students toward higher credentials. Regarding collaboration on programmatic elements, one faculty respondent in Arizona described partnering with the University of Arizona to facilitate deeper collaboration between technicians and engineers in the regional labor market.

Partnering with other community colleges.

Some of the most compelling examples of partnership were among community colleges and focused on collaborative development of training offerings from a regional perspective. In these cases, community college partnerships led to the development of broadly relevant curricula built through direct engagement with the regional needs of employers and the state. These collaborations were often instigated by large employers or via ongoing convenings by state-level organizations, including educational associations, industry associations, and ATE-funded technology education hubs. The benefits of strong, state-level convening organizations can be seen in the high-level coordination among case study colleges in Arizona and Ohio.

In Arizona, colleges collaborated through AzAMI. AzAMI is a district-wide entity whose leadership acted as a convener not only of multiple community colleges across Maricopa County but also of regional economic development actors and local industry leaders. AzAMI's connections to economic development actors such as the Arizona Commerce Authority facilitated and financially incentivized community college collaboration on the development of the AIT program, building from the colleges' individual existing mechatronics programs. The colleges involved in AzAMI were more broadly connected through the Arizona Commerce Authority's Arizona Advanced Technology Network (AATN), a branded network of colleges intended to act as a front door for industry to the region's workforce development infrastructure, and through Arizona's more recent ReadyTechGo network hosted by the state's Office of Economic Opportunity.

Our case study colleges in Ohio collaborated in several unique and regionally responsive ways. For example, they worked together to collaboratively prepare training designed to meet Intel's labor needs as the company moves into the state on an ambitious timeline. Lorain and Columbus State were each leading a separate Intel grant. Lorain's Intel grant funded the Ohio TechNet Northeast Ohio Semiconductor Workforce Consortium, which facilitated collaboration among ten educational institutions to develop curriculum, faculty training materials, and experiential learning programs. Independently, Ohio TechNet, a state-subsidized organization that co-locates with Lorain, provided access to resources and technical assistance for its member network of educational institutions, with a broader vision of assisting community colleges in developing, incubating, and sustaining manufacturing and other technical programs to meet statewide industry needs. In collaboration with the Ohio TechNet consortium, Lorain and Columbus State were in the process of helping other community colleges replicate earn-and-learn models through the Manufacturing Experiential Advancement Readiness Network. Relatedly, the Ohio Cooperative Education Association, composed of all colleges within Ohio, brought colleges together with employers for conferences and facilitated discussions about co-ops and internships, experiential education, and work-based learning. Separately, Columbus State led the Intel-funded Ohio Semiconductor Collaboration Network, which brought together several other Ohio community colleges as well as the Ohio Association of Community Colleges (OACC) to develop two-year pathways, including a bootcamp, leading to semiconductor technician work. OACC, which represents community colleges at the state level, lobbied for important legislation that supports community colleges and their capacity to respond to changing demands from industry; we learned that Lorain was among those colleges that worked with OACC on those efforts.

Both Daytona State and Gateway collaborated with other colleges within their regions through formal organizations. Daytona State is a member of the Florida Advanced Technological Education Center of Excellence (FLATE), which brings together colleges, businesses, industry, and vendors. FLATE is a part of the FloridaMakes Network, which is the National Institute of Standards and Technology Manufacturing Extension Partnership (NIST MEP) Center in Florida and a member of the MEP national network. Daytona State representatives learned about new directions in manufacturing and other schools' training innovations at FLATE events. Gateway was a member of the Higher Education Regional Alliance (HERA), a collaboration of two- and four-year colleges and universities in southeastern Wisconsin. HERA members work together both to address collective concerns such as obstacles around building student pipelines and to collaborate around activities such as increasing students' attendance across schools' career fairs.

Inclusion as a partnership approach

Respondents described employing a variety of strategies to broaden the populations that benefit from their technician education offerings. Just as colleges sought to build a web of interrelations in the regional industry ecosystem, they also sought to develop relationships within their communities through partnerships with community-based organizations (CBOs). In particular, CBOs helped colleges with outreach to a range of underserved and marginalized groups, many of whom are underrepresented in manufacturing-related technical

education programs. While designing industry-relevant programs, colleges pursued enrollment strategies such as securing grants to serve specific populations and conducting outreach directly or in close partnership with CBOs.

Some efforts were part of college-wide recruiting strategies, and others were program-specific. For example, Lorain's Project Lead the Way recruited a racially and ethnically diverse population of high school dual enrollment students for their college programs. Other efforts were more program-specific; Mesa intentionally scheduled and structured their technician education programs to attract more women and first-generation students based on feedback from previous students. Notably, the college removed the barrier of tuition through its collaboration with economic development actors and offered schedules that prioritized weekend and night classes. Representatives from several colleges in this study emphasized the importance of targeted outreach to women and to Hispanic communities.

At times, strategies were pursued via specific organizational partnerships or dedicated funding streams. Respondents from Gateway described contracts with correctional facilities to train justice-impacted individuals. In Ohio, Clark State had secured an H-1B grant to conduct concerted outreach to returning citizens and people in recovery; the college also worked on outreach with a local women's organization and a local organization advocating for people with disabilities. Lorain worked with community organizations such as El Centro and the Urban League to conduct outreach to underserved communities; additionally, in the nearby cities of Oberlin and Aleria—where there were already relevant, existing initiatives to help local residents upskill—Lorain connected with community organizations engaged in those efforts. In Arizona, Estrella Mountain worked with a Veterans Program on Luke Air Force Base, and Mesa enrolled multiple cohorts of women in their QuickStart program through a partnership with Fresh Start Women's Foundation.

Intentional outreach to and support for currently enrolled and recently graduated students were key parts of colleges' approach to retain and advance students. At Mesa, career navigators helped current students obtain financial aid and enroll in specific programs according to their goals. Navigators also conducted outreach to students after they left their programs to find out whether they were employed and to invite them to return to the college if they were interested in additional training. Gateway's career and employment office worked with industry partners to raise current students' awareness of regionally available jobs. The information provided included median earnings associated with specific certificates, technical diplomas, and associate degrees. Gateway also intentionally sought out employer partnerships that would allow current students to earn wages alongside funding they could apply toward their tuition.

In certain instances, colleges incorporated inclusion at the level of the community and as part of their wider, regional work. Programs that educated students and workers about career opportunities and related earnings also sought to bring community participation into strategic planning efforts on campus. For example, Columbus State provided access on campus for poverty summits. Lorain engaged their local community in long-term strategic planning processes in addition to participating in the Aspen Institute and Community College Research Center's

Unlocking Opportunity project, which was designed to assist colleges in offering programs that lead to family-sustaining wages. Gateway faculty visited community centers and made their Industrial Design Fab Lab accessible to community members.

Conclusion

Our assessment of the economic development activities described by administrators, faculty, and staff at community colleges suggests that the ways in which colleges implement education and training, business support, and regional engagement activities are intimately linked and locally tailored. We learned about the student and worker populations college manufacturing programs serve and about the ecosystem of regional partners with whom colleges collaborate. We also learned about community colleges' resources and facilities and how they support business and regional innovation. In examining actors and strategies across the eight case study colleges, we find that actors use their degree programs to anchor short-term workforce training efforts (e.g., bootcamps, QuickStart programs), and they use strong partnerships to inform their training offerings as well as strategize around longer-term demands on the regional workforce. Moreover, institutionalizing colleges' collaboration and coordination efforts with regional industry and with their regional economic development partners helps to equip them in responding to the fast-developing needs of manufacturers.

We find that college actors' regional engagement and business support activities are not easily separated from their education and training activities. Instead, they are part of delivering effective industry-relevant programs. Further, the extent to which colleges participate in business support or regional engagement activities varies according to the college's resources, its size, its institutional and manufacturing sector–specific histories, and the dynamics of its regional ecosystem. Differences in colleges' employer engagement strategies are also related to variations in the types and sizes of manufacturing companies in their respective regions and in their relevant subsectors.

Inclusion is a top priority among college stakeholders, reflecting the long-standing community-oriented missions of community colleges, but how inclusion is operationalized at each college varies significantly. Broadly speaking, an inclusive approach to economic development centers the needs of the community, including the most vulnerable workers in the regional labor market. We observed examples of colleges opening their facilities and spaces for community use and training vulnerable populations with skills that would translate into wage growth. Employers also expressed interest in greater inclusion; respondents from the colleges' employer partners discussed goals around reflecting greater inclusion of specific populations, especially women, in their workforce. We find that partnerships with the public sector and community-based organizations are critical to colleges' approaches to inclusivity.

Community colleges are contributing to economic development through a range of activities and strategies. We find that colleges are responding to the fast pace of technological change, supporting innovation and productivity, and collaborating with multiple types of partners within their regional economic development ecosystems.

As illustrated in the HII conceptual model, the activities described in this report offer a way to think about community college contributions to communities and regional economies broadly while also considering their more specific contributions to students and local employers. In future research, the conceptual model can be elaborated to accommodate the substantive overlap between education and training, business support, and regional engagement activities, and to reflect the centrality of education and training to community colleges' contributions to economic development. Learning how technician education programs serve as a uniquely productive vehicle for integrating these different economic development activities and their respective audiences on behalf of manufacturing ecosystems is important for understanding how the conceptual model is put into more general practice by community colleges nationwide—and how it might be adapted to further enhance the community college role in economic development more broadly. College faculty and staff beyond these eight case study schools might use the catalogue of activities presented in this chapter as a basis upon which to consider their own education and training activities, employer partnerships, and regional ecosystem engagement in the context of economic development. Doing so may yield insights into their own programs' connections between training and economic development.

Chapter 2: Employer Contributions

Introduction

Employers are increasingly recognized as essential partners in education-and-training-program design and implementation, but the nature of their participation varies widely from passive to more active. In this chapter, we discuss how various employers work with their local community colleges to help students and workers gain skills in demand by their regional manufacturing sectors. We also present examples of when such efforts led to stronger regional coordination between colleges and employers in our study. These findings are based on insights directly from the employers partnering most closely with the case study colleges.

Although the policy and academic literature on technical education routinely mentions employers as important clients and beneficiaries of community colleges and the programs they offer, there is little empirical research addressing the employer perspective on the role of the community college in economic development processes and outcomes. What should we expect to hear from employers who are the colleges' closest partners in training and education? To what extent do the perspectives of these employer representatives reflect our conceptual model for colleges' economic development contributions?

Guided by the project's conceptual model (see Figure 1), we asked employer representatives about their community college partnerships and their results for students, businesses, and regional economic development. Since employers and their workers are some of the most important intended beneficiaries of community college technician training programs, their perspectives are critical to our understanding.

Five themes that we explored with employer partners regarding the college's role in regional economic development include (1) College responsiveness to individual employers; (2) The division of training responsibilities between colleges and employer partners; (3) The contributions of colleges and employers to the manufacturing industry and the regional economy; (4) How partnerships are grounded in community and industry networks; and (5) College-facilitated collaboration between employers.

Figure 1. Conceptual Model of Community Colleges and Economic Development
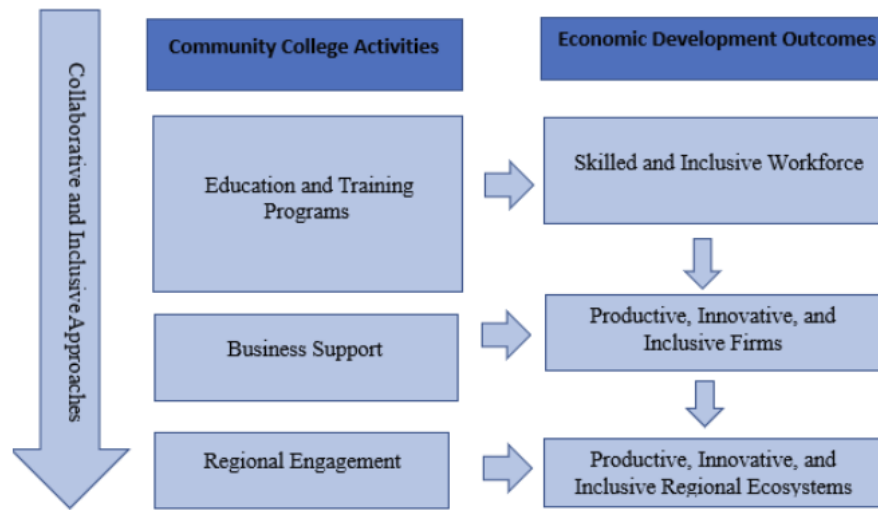
Main Findings

Insights from the chapter include:

➢ Employer partners found colleges to be providers of valuable skills foundations while recognizing colleges could not provide 100 percent of the training workers need to succeed.

➢ Over time, via long-tenure partnerships with colleges, employers recognized that colleges could also support more specific skilling in the context of the workplace and workplace technologies.

➢ Some employers took on a regional industry–oriented perspective to skill building. Larger firms had the capacity for more regional approaches to industry-specific skill building, and in some places, smaller firms were critical contributors.

➢ Partnerships among employers themselves enhanced industry-oriented skills development at a regional scale. State support for industry coordination provided important motivation and structure for those partnerships.

➢ Colleges were credited with important coordination work in their regional ecosystems, including facilitating employer-to-employer connections brokered through employer involvement in curriculum and program development.

We observed how, as employers' commitment to training and its benefits increased, employer champions emerged as advocates for investments in community colleges in their regional economic development ecosystems. Champions included larger companies, companies seeking to build a stronger local high-tech sector or talent pipeline, and companies with positive, long-standing experience working with the community college. We find that, with this support, colleges can more quickly jumpstart and more effectively sustain successful technician

education programs. Colleges may also need to develop new independent coordinating mechanisms, often made possible with support from the state. Employer champions can then reinforce productive institutional arrangements that lead to more mature ecosystems.

College Responsiveness to Individual Employers

Employer partners in our study found colleges to be responsive providers of valuable skills that helped meet their workforce needs.

Employers described having dedicated and involved relationships with colleges. In general, they recognized and valued the technician training the colleges provided. Many employers in our study had long histories in their regions, but some were relatively new arrivals. For some, their college partner was the only technician training provider in the area, making that college's services essential to their survival; others had their pick of training providers and selected the community college partner for a competitive advantage or a precise service-delivery role.

Employers generally described themselves as the central actors in their relationships with community colleges and as playing a leading role in soliciting their services. They reported that company representatives typically initiated, directed, and leveraged college-provided training, offering ideas or initiating requests to which the college actively responded. Employers helped colleges create new or improve current curricula; in cases where colleges already had relevant programming, employers helped to tailor programs to better fit their needs. They assisted in the design of new programs either for their own customized training purposes or to address a particular set of skills needed by multiple businesses in the region.

Employer partners said community colleges offered valuable student experiences and were easier to work with than other training partners. One company praised graduates from their partnering college, saying they "get a lot of hands-on experience." Another commented on the ease of working with their partnering college rather than the larger state university, noting, "Everything is so much faster and less complicated." A third employer partner said they wanted to work "hand-in-hand" with their partnering college to build a new apprenticeship program together.

Every college in our sample received praise of some kind from their employer partners. The following descriptions from employers reveal the level of satisfaction they feel with their community college partnerships:

> Ohio: "Not only do they have the talent to teach the material, but they also have been exceptional with reaching out to local industry and asking yearly, 'What do we need to do to make sure we're staying up with technology?'"

> Arizona: "They were really accommodating and always willing to talk about how to get stuff done in a way that's good for the school and that's good for [our firm]. I think both of us have each other's best interest at heart; it's a true partnership."

Employer partners recognized the gap community college training programs fill in the training landscape. They viewed colleges as legitimate partners in building adaptive models for technician education that require support and investment. One employer described feeling a responsibility to contribute more to the relationship with their college partner, saying, "We need to be [even] more involved with them. We need to build a better recruiting pipeline and drive the curriculum."

The Division of Training Responsibilities Between Colleges and Employer Partners

Employers looked to their partnering colleges for workers with general skills and sought increasingly specific skills as trust increased over time.

Community college programs offered education and training in general skills that could apply to identified industry needs, and they provided direct exposure to specific technologies and work environments, including industry-specific ones. Employer partners valued a combination of theory and practice, as well as a balance of hard and soft skills. They noted how workplace skills may be developed through various methods—e.g., in a traditional course format, through hands-on learning in a job setting, or a combination of both. Recognizing the contributions of colleges to a skilled workforce, employer partners described how community college courses provided both general and industry-specific skills, all of which helped students develop fundamental competencies relevant to a productive manufacturing sector. They referenced machine operation, safety training, and professional or "soft" skills like communication as important concepts learned in community college courses.

Employer representatives from both small and large firms described working with college partners to develop curricula for industry-specific skills important for the regional sector. This included skills that graduates and trainees could immediately apply on the job site. Some colleges worked with their employer partners to develop industry-specific skills profiles for program graduates that reflected regional needs. Across the sample, all employer partners emphasized the importance of hands-on experience with local manufacturers for high-quality, relevant technician skills.

Some employers viewed hands-on experience as best gained at the job site. As one employer explained, "We get feedback that they learn the most here [at the business]. The classes help, and you need that basic knowledge. But getting real hands-on experience helps them retain what they're learning."

Colleges' contributions to their partnerships with employers took many forms. These included earn-and-learn programs, apprenticeships, after-hire trainings, and other forms of customized training for incumbent workers. Several employers in our sample described variation in the same college's role over time and depending on needs, including iterative approaches to workplace learning. Employers' contributions to their college partnerships also took many forms, and some were directly involved in classroom instruction. For example, one employer partner

described the benefits of teaching a class, noting "the classroom is a chance for me to kind of see who's got mechanical aptitude, and if they don't, if they are able to listen and follow procedures."

A few employers explicitly sought training designed to benefit the regional manufacturing industry, not just their individual company. For example, one large employer provided content to create a new short-term training program that would be available to others in their industry. A representative from that firm explained, "We're looking to make sure that curriculum is shareable, that others can copy it into their own programs." In another case, several small employers co-invested significant resources into researching and designing a training program that they kept open for any interested business to co-sponsor. Finally, one employer partner representative praised the collaborative work that college faculty were leading among multiple employers in their region, specifically applauding the resulting dialogue among manufacturers.

The Contribution to the Manufacturing Industry and the Regional Economy

Most employer partners engaged with colleges to meet their own needs but maintained a view of broader regional needs. Some focused on improving the regional talent pipeline from an industry-oriented perspective.

Employer partners articulated a variety of motivations for working with community colleges. One motivation was necessity—to "just get by" or remain relevant in manufacturing. In these cases, the local community college may have been one of the few or only viable training providers in the area. Other employers described their motivation for partnering with community colleges as an innovative pursuit to develop a regional talent pipeline from which they, and possibly other firms, could directly benefit. Still other employers highlighted the importance of being leaders in the national industry and of providing replicable models for training in manufacturing-relevant skills. In most cases, motivations were mixed—employers sought to leverage colleges' training for their own in-house growth and technology uptake and acknowledged the importance of a robust regional labor market.

Table 2.1 illustrates the range of motivations described by community colleges' employer partners. The table includes details about the employer partners' firms and their program involvement.

The table suggests there may be a relationship between employer size and motivation. Larger employers appear to have had greater capacity for motivations broader than their own benefit, which enabled them to take on a more industry-oriented perspective to support regional development of the talent pipeline. Of course, this was not always the case. Some large employers were openly uncollaborative, perhaps due to their size and lack of need for co-investments. But because larger employers paying higher wages and with stronger brands and reputations did not have to worry as much about their competitors, they may subsequently have been more open to collaboration.

Table 2.1 Description of Employer Partners' Primary Motivation for Program Involvement

Primary Employer Motivation	Firm Size	Type of Firm	Program Involvement Detail
Survival	Small	Steel and cylinder manufacturer	Participates in tools program
Survival	Small	Welding/metal manufacturer	Participates in CNC program
Talent Acquisition	Small	Steel manufacturer	Develops ad hoc customized welding courses offered in-house and at college
Talent acquisition	Small	Electricity product manufacturer	Sponsors apprenticeship programs and mentorship; provides in-house training
Growth and diversity	Unknown	Steel manufacturer	Participates in steelmaker program
Talent acquisition	Unknown	Innovative healthcare research and development manufacturer	Develops bootcamps, apprenticeships, tools program; involved with state organizations
Talent acquisition and community orientation	Large	Electricity provider	Sponsors apprenticeships; provides in-house training; provides adjuncts and equipment
Talent acquisition and community/industry orientation seeking inclusive growth	Large	Gas provider	Provides adjuncts
Talent acquisition and goal to lead and give back to community and industry	Small	Blade manufacturer	Participates in CNC, EMMT, AMT; provides adjuncts; serves on college board; contributed to new college facility
Talent acquisition and support for local industry	Unknown	Defense manufacturer	Participates in AIT; microcredentials; provides in-house training; board membership on multiple state and industry consortia
Talent acquisition and seeking to engage younger generations	Large	Appliance manufacturer	Involved in all relevant program development, including robotics; conducts required courses for employees; develops electromechanics apprenticeship
Develop regional industry and community with stronger community college talent pipeline and technology uptake	Small/growing	Electric manufacturer	MEMS certificates, associate and bachelor degrees, with earn-and-learn; strong advisory board and curriculum development involvement
Talent acquisition; seeking collective action by industry to address talent gaps	Small	Boat manufacturer	FAME, Founder of FAME
Collaboratively develop regional industry and community	Medium	Simulation hardware manufacturer	FAME; FAME board member; leads regional manufacturing association

Primary Employer Motivation	Firm Size	Type of Firm	Program Involvement Detail
Collaboratively develop regional industry and community to grow high-tech manufacturing in the region	Small	Niche lab and equipment manufacturer	FAME; Advanced Technology Center; chair of FAME board
Collaboratively develop local industry, supply chains, and community engagement with advanced technology focus	Large	Semiconductor and electronics manufacturer	QuickStart program; AIT; strong advisory board and curriculum development involvement; equipment provider; leads industry consortium
Develop regional industry and local community	Large	Aerospace manufacturer	AIT; involvement in AzAMI and state initiative; provides adjuncts
Develop national industry and local community with focus on advanced technology	Large	Influential semiconductor manufacturer	QuickStart program for semiconductor technician certificate; AIT; strong advisory board and curriculum development involvement; equipment provider; involvement in state initiative

Strong Partnerships

College efforts to implement regional strategies led to the development of strong relationships with employers over time that centered on distinctly regional industry needs and were grounded in regional networks. Employer partners found such relationships beneficial.

Employer partners with the most comprehensive view and use of college offerings had long partnership tenures. Half of the employer partners we talked to worked with a college iteratively over time. These employers had a consistent college partner available to develop new programs and address issues as they arose at the workplace. At one firm, virtually all technicians had enrolled in some program at the partnering college. That employer partner had been involved in developing programs at the college for approximately seven years, and programs became required for technicians as the business expanded. Another employer supported their college partner's program development and program updates over time for the benefit of the regional manufacturing industry, and that support was also directly helpful to their own business expansion.

These examples are important because they suggest that as employers engage more with community college technician education programs over time, they reap more benefits, and their commitment to the college partnership grows. Some employer partners described in detail the benefits of their college partnership to their business and their deep commitment to the partnership as a result:

> *Having that partnership has had a huge impact for us. When we think about building a second mill, the people are here, the environment's great. We have the resources and can benefit from those*

graduates in multiple areas including our research and development area. It's a huge part of our business. I always tell [head instructor of college], "You're producing twenty people a year or twenty per semester. I'll take, you know … How many you got?"

In some cases, partnerships inspired deeper commitments by employers to training their own workforce. One company created three registered apprenticeship programs with their partnering college. They described the experience this way:

We really need to develop our own highly skilled workforce; we can't rely on the competition that's coming from the colleges for the graduates. So, the alternative method is, "Let's train our own through these apprenticeship programs." Four years, it's 8,000 hours of on-the-job training, along with related instruction that's required during those on-the-job training activities. This is where our partnership with [the college] has been really valuable because we've been able to take on a program that we want to develop. We meet with all the heads of the departments, and we develop the curriculum that matches our on-the-job training requirements. Then, we submit to the Ohio State Apprenticeship Council for their approval.

Other employers indicated specific interest in scale and were enthusiastic about launching a program that would serve the regional industry. One employer discussed their involvement in a program intentionally designed to serve the regional manufacturing sector, noting, "I was one of the early board members for that. That is my passion because it is investing in our future. We know that the talent [the college] outputs is phenomenal. Although it's been a slow start for them, the growth has been exponential." Relatedly, another employer discussed working with their partnering college to build a curriculum that would reflect a baseline for a regionally- and industry-specific skillset. They narrated the process for that collaboration, including the role of an active, state-level workforce development organization, explaining:

We came into Ohio and dealt with JobsOhio, which is an organization that ultimately helps with workforce development, and they connected us with the state to help us build. The bootcamp was presented to us as an idea for building skill in this community and in the region that are needed from the industrial parks. [And so] we met with [the college] and helped build this curriculum. We told them what types of things we thought were important for people to know as baseline information and things that would help orient them to our industry.

One of the strongest industry-oriented partnerships we studied was one ongoing between Mesa and a large semiconductor manufacturer in Arizona. Industry-focused program development had led to the expansion of this partnership and to the involvement of other employers in the regional semiconductor industry. A respondent from the large manufacturer, who considered their relationship with Mesa a "true partnership," explained how they had been working with the college for decades as a trusted talent source with the ability to develop and adapt curriculum effectively to meet their evolving individual firm and industry needs. The employer partner described having relied on their partnership with Mesa "for decades just because of the need for the talent that comes out of

there." As an extension of this partnership, and with input from multiple employers in the regional semiconductor industry, Mesa helped create the QuickStart program as a baseline for semiconductor skills training, which was intentionally designed to service the broader industry rather than one business. While Mesa's original employer partner described their strong involvement in the development of QuickStart as relatively unique compared to their standard practice, their long-term partnership with Mesa provided a foundation of trust and confidence in the college's curricular expertise that enabled their participation and helped frame it as a useful investment of company resources. That in turn benefited other businesses in the semiconductor industry in the form of a regional asset and integral piece of industry-specific training infrastructure. The partnership around QuickStart also highlights the importance of state and wider-ecosystem support for such efforts, given this program's support from the State of Arizona and local economic development partners.

While employer-college partnerships generally led to deeper employer commitment to community college programs and to greater employer reward, employers' involvement with community colleges, including their recruitment from colleges' graduate pools, sometimes became less formal or waned over time. For example, some employer partners referenced temporarily reduced program development and student recruitment efforts during the COVID-19 pandemic. Some discussed plans to more actively re-engage, especially given increasing post-pandemic national and regional investment in the manufacturing industry and the need for skills to meet those demands. Broadly, weakening or informalizing partnerships over time was the exception, not the rule, and appeared to be driven in part by external factors, including changing economic conditions.

College-Facilitated Collaboration

Employer partners praised colleges' regional efforts around collaborative skill development and curriculum design, crediting them with facilitating firm-to-firm connections and industry-wide coordination. Such efforts aligned firms' investments and reinforced colleges' ability to meet immediate and future skill requirements with support from industry.

One of the main ways colleges facilitated firm-to-firm engagement was through advisory boards. Designed often with specific college programs and corresponding industries in mind, advisory boards usually involved representatives from the college and a mix of different-sized businesses from the regional industry. Employer partners had generally positive perceptions of their participation in college-hosted advisory boards, describing multiple benefits simply from being in the same room with other manufacturers discussing important industry-related issues that affected manufacturing businesses of all sizes. Topics that advisory boards discussed in their meetings included instruction strategies, potential curriculum improvements, partnership and funding opportunities, student enrollment and progress in programs, recommended courses for students, and effective business recruitment strategies from programs. Advisory boards put relevant businesses in the same room, creating and deepening linkages within the regional industry.

Colleges provided other forums for communication and coordination among employers in the regional industry. For example, when one employer requested a curriculum to be developed by a college that the college thought could be useful to multiple businesses, the college put them in communication with representatives from other businesses who also had established channels of communication with the college for offering input on programs to meet evolving industry needs. College-facilitated joint curriculum development was repeatedly mentioned as a productive vehicle for industry-wide collaboration. Some large employer partners of the colleges in this study made significant contributions to the development of new curricula designed to serve as a baseline skills profile for the regional industry and intentionally made them open for use and adaptation by other area businesses.

Table 2.2 presents evidence from employer partners regarding how, through community college advisory boards or other informal methods via the college, communication or collaboration with other manufacturers in the regional industry was strengthened. In some cases, this occurred among businesses that would otherwise not have interacted with one another, or that would have viewed each other as competitors.

Table 2.2. Examples of Business-to-Business Collaboration Facilitated by Community Colleges and Their Potential Benefits, as Reported by Business Partners

Employer Partner's Account of Collaboration & Benefit	Theme
"My personal belief is that it's a good thing for our economy, it's a good thing to keep jobs here and build everything domestically that we can. How can we expect to have those resources available if we don't invest in them? So, it's more than just [our company] looking at it, [saying], 'What can they do for us?' [Instead, it's], 'What's the right thing to do?' [The college] is not just here, they're contributing; we get our money's worth more. I'm very glad that they took on FAME. It's something I wish we could champion in more places in Daytona. **I wish more companies understood and participated locally, and then across the state, too**, because we're the first chapter in Florida. So, I think: 'How do you get that information out so that people are willing to participate?'" (Lab manufacturer)	Employer partner on the value of community colleges and the benefit of having more firms participating in college-led collaboration efforts.
"I love that we invited our competitors to the table. It was a little over half of the people that have gotten together before. So you know, it's more impactful. The more people we can get , [the more] the community [is] interested is important." (Healthcare research and development manufacturer)	Employer partner on the value of working with firms they have engaged previously, including competitors.
"There is an advisory board. And the advisory board might [involve] a PowerPoint where [a college representative] is going over the program. Then he opens it up for questions. In addition, he will periodically send an email out saying, 'Based on conversations I've had with several of you ...'—and you know, he's got a whole list, a mailing list of 30 or 50 people—**'I'm looking at adding this capability to the program. I would appreciate your thoughts on this.** Should this be a priority? Do you have suggestions? This is what I've come up with so far.' And so, he's [saying], 'If I'm going to teach something, I want to teach something that's widely used at your [sites].'" (Electric equipment manufacturer)	Employer partner on the valuable elements of advisory board participation.

Employer Partner's Account of Collaboration & Benefit	Theme
"The advisory board is really providing input on the curriculum. [It has been] really helping [the college] out with identifying who from the industry needs to provide input. **When you think semiconductors, you think of just the chip manufacturers, but there's so much more to it. There's the equipment side of it, there's the supplier side of it.** So making sure that we offer that holistic view, and are inclusive of all the companies that are part of the industry, that was my role, making sure that we have representation from all parts of the industry." (Semiconductor and electronics manufacturer)	Employer partner on getting industry feedback on curriculum, and who 'the industry' is for the regional semiconductor industry.
"**The open communication has been a huge benefit**. By having openness of communication [about what colleges] are doing in those classes, good, bad, and ugly, is a huge value to employers. To know, 'How are the employees performing? What are they getting? What do they need to learn?' and coach them on [those things]. [And] even on professionalism, has been a huge benefit. So, I would say that communication has been really huge." (Semiconductor manufacturer)	Employer partner on the benefit of open communication with their partnering college.

In some cases, the coordination work of colleges supported more coordination on a regional industry level. One employer partner reported that their involvement with FAME at Daytona State coincided with other synergistic attempts to collaborate with other like businesses through the local manufacturing association. The defense manufacturer said many local manufacturers were experiencing the same issues and that working together and sharing resources could help solve problems. The general manager at the firm took the lead in developing a leadership group to facilitate more industry-oriented collaboration:

> We're looking for best practices. And for years, [the local manufacturing association] lost that. When I became chairman, I said, "That's something I want to bring back." And so I started this executive leadership group. We all have the same problems, right? We were all trying to figure out how we're going to get through COVID. How are we going to deal with the supply chain issues? How are we going to deal with the labor pool issues? And so we've come together, and [we] meet once a quarter.

The employer partner continued, elaborating on what challenges the new industry coordinating forum seeks to tackle:

> And we've come up with some really cool solutions, sharing ideas. I've built out a complete business plan. And I have a whole thing together, called a collab. And basically, it's going to be an opportunity for employers to share resources. So, we all have ebbs and flows, and to prevent layoffs, which is a nightmare for everybody involved, we can help each other out. No one's really done that in this area. You know, I've been studying this, and [thought], "How do we protect each other from poaching?" Poaching is all fair in love and war, but there is a way that we can do this professionally, ethically, and come to an agreement, and it's going to take work, and it's not going to be easy. It started as half a joke. We were at an engagement, and we were half joking because we were all

having the same problem. And then it got more and more serious. And the last meeting that we had, [I said], "Okay, this is what I'm going to focus on." [I] put it together, and I'm going to push it forward. It's not perfect. But I think I can sell it. (Defense manufacturer)

This response illustrates how colleges' support of collaborative efforts can be catalysts to opening the floor to wider conversation about key industry-wide issues. One employer partner from a large business working with Gateway described the challenges of recruiting qualified technicians amid the constant poaching across the industry that had become necessary to meet employment needs as the industry grew. Their partnership with Gateway developed as a result of these challenges, with objectives to improve the general technician pipeline in the region and to meet the technical demands of a field that required significantly more training compared to 20 years earlier. They also wanted their collaboration with Gateway to serve as a model for expanding interest in manufacturing among younger generations. Together, Gateway and their employer partner developed clearly defined courses that became required by regional manufacturers for employment and advancement opportunities, establishing transparent training standards for areas like automation. This employer partner described their work with Gateway as groundbreaking and key to their firm becoming industry leaders in the Midwest.

A more regionally aligned labor market with investments and input from across the regional industry is ultimately better not just for colleges and students/workers but also for the employers themselves. Businesses may be understandably apprehensive about investing in industry training programs that may also benefit competing firms. But community colleges can help mitigate those concerns by demonstrating the benefits to the broader industry of more aligned and better-resourced baseline skills tailored to regional industry needs, even if businesses may compete for students graduating out of the same programs. Ultimately, employer collaboration on regional industry training through community colleges can serve as an alternative to the resource-intensive methods of in-house training or poaching, which may become more difficult and less sustainable as technology rapidly changes and senior employees retire in large numbers.

Observations on Innovation

Community colleges and their employer partners are still identifying—and finding language to articulate—how technician education programs are linked to innovation processes. If the link were to be made clear, these programs could improve how they support innovation in manufacturing in the United States, including in the production and adoption of critical technologies related to American national security and defense. Colleges could help pinpoint the talent and skills needed to compete globally in the context of fast-paced technological change.

In order to begin to assess community college contributions to innovation, Table 1 summarizes some examples, including from the shop floor, the broader firm, and the regional manufacturing sector.

Table 2.3. Examples of Community College Contributions to Innovation Through Technician Education Programs

Level of Innovation	Contribution	Explanation
Shop Floor	A new training software	The firm historically used hard-copy paper handouts alongside in-person mentoring by a firm veteran; the firm had experimented with a new software platform but found that it required a patchwork of skills to operationalize and maintain, including technical writing capabilities, technical knowledge of the relevant manufacturing processes, and a good foundational knowledge of software. The community college student who interned with the firm began using the software platform and realized he had the requisite skills to improve it. For the firm, these upgrades significantly reduced the time veterans needed to be involved in training and simultaneously standardized shop-floor best practices so that inefficiencies were not passed down informally. With training software operationalized effectively, the firm was able to put in place a new firm-wide approach to training that cut costs and improved the effectiveness, as well as the efficiency, of onboarding new employees, including future community college interns.
Production line	Local batching and testing	An employer partner representative explained that having a regional labor force technically skilled in manufacturing allowed the firm to expedite new product introduction because the firm was able to test products locally in smaller batches as opposed to overseas with an international supplier; with local partners, they were able to find and correct errors in new products more quickly. This regional capacity reduced the timeline for introducing new products from a couple of years to a couple of months. The representative also spoke to the availability of well-trained technicians with thorough knowledge of regionally relevant manufacturing processes who are able to not only identify but diagnose problems quickly so they can be addressed at their root cause. This problem-solving capacity was noted as important beyond new product testing and was directly linked to the type of hands-on training that community college technical education programs feature, in contrast to more textbook-based university training for engineering degrees.
Regional industry	Coordinating the business landscape	Across the eight colleges, there were many instances of community colleges facilitating coordination within regional manufacturing sectors. Colleges were openly credited with facilitating firm-to-firm connections and opening lines of communication among regional employers about collective investment in the regional labor force. In one instance, the collaboration among firms through the college led to more active coordination within their regional industry association and a spin-off effort through which regional manufacturing firms explored ways

Level of Innovation	Contribution	Explanation
		of sharing resources for shared technical problems. College-facilitated coordination among firms not only indirectly equips them for greater innovation capacity through more and better-coordinated investment in the regional labor market, but that coordination effort has also directly led to firms' own collaboration on other fronts, including technical problem solving among manufacturing firms in a particular region.
Regional industry	Creating opportunities for technological experimentation	Community college stakeholders highlighted challenges around the pace of technological change and their efforts to update workers' skills accordingly. College representatives noted that many firms in fact look to the college for guidance on trends in technological innovation—in particular, what it means for training new workers. Colleges have realized that they need to play a leadership role in ensuring their training reflects the most current technological trends in manufacturing; they cannot wait for industry to relay what it needs. This is because industry doesn't consistently know its needs, and even when it does to some extent, technical education programming will always be lagged if colleges wait to hear from industry. This delay significantly undermines the region's global economic competitiveness. Yet, staying abreast of technological changes to manufacturing processes and their implications for training is difficult and resource-intensive, and colleges are often not funded to do that work. One way colleges in this study address this problem is through physical hubs or spaces on college campuses established in partnership with regional employers and outfitted with state-of-the-art technology. These hubs are often co-founded by more than one employer and viewed as a collective investment and asset, not just for training but for lower-risk experimentation with new technology by firms. Large firms often play an outsized role in facilitating the establishment of these types of facilities in partnership with colleges. In some cases, these college-hosted hubs offered small and medium-sized firms unique opportunities for exposure to and experimentation with new manufacturing technologies to which they otherwise did not have access.

Discussion & Conclusion

Employers sought and sustained their interactions with the eight community colleges to acquire talent, develop the skills of their employees, and develop high-tech manufacturing in their regions.

This chapter provides insight into the dynamics of employer-college partnerships and the challenging conditions under which community colleges operate to fulfill employer demands. It also informs our understanding of how multi-stakeholder involvement in community college technician programming may contribute to regional economic development through multiple pathways, including more coordinated regional industry efforts. While our study examines the ways in which employers leveraged their relationships with community colleges for their own benefit, it also reveals that some employers had broader industry-focused motivations, including the development of stronger regional labor markets tailored to the needs of manufacturing and of a more robust training infrastructure for technical skillsets. This practice aligns with literature on the growing relevance of collective firm engagement on skill development within regional industry sectors.[2]

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[2] Porter, M. E. (1998, November–December). Clusters and the new economics of competition. *Harvard Business Review*, pp. 77–90. https://hbr.org/1998/11/clusters-and-the-new-economics-of-competition

Chapter 3: Ecosystem Analysis

Introduction

The HII conceptual model theorizes the role of community colleges in economic development processes at three levels with an increasingly macro scope and with a different audience in mind at each level: students/workers, businesses, and regions. At each level, particular areas of community college activities are linked to broad economic development outcomes of interest: education and training with students and workers lead to a skilled regional workforce; business support leads to more innovative and productive firms; and regional engagement with other ecosystem actors leads to a more productive, innovative, and inclusive regional economy.

This project investigated the ways that college activities were organized and operationalized in order to better understand how technician education at community colleges can further drive regional innovation and economic development. Economic development ecosystems are multifactorial and dynamic, and they are subject to incentives and constraints that shape the presumed role(s) of participants and contributors, including the presumed role(s) of community colleges and employer partners. In this final chapter, we ask whether the actions of colleges, employers, and regional leaders were aligned with the broader economic development strategies and processes of their regions.

To further elaborate on the themes explored in this report regarding college activities and employer insights, we solicited additional regional economic development partner perspectives to understand the community college role in economic development. We found that these other actors within regional ecosystems may influence the role(s) that community colleges go on to play. Regional economic development partners of the case study colleges include chambers of commerce; economic development organizations; educational institutions, including K–12 institutions and higher education-focused entities; workforce development organizations; industry-affiliated partners; CBOs; and unions.

The mix of partner types for any one of the case study colleges varied across the sample. Together, economic development organizations, workforce development organizations, and chambers of commerce represented over half of the pool of regional economic development partners to the colleges in this sample (65%). Survey results and interview responses from regional partners contributed to our assessment of the regional ecosystem dynamics.

Survey Findings

Regional partners responding to the survey reported that their partnering colleges (1) provided high-quality training and education to enhance technical skills for manufacturing in the region; (2) made a unique contribution

to and added value to regional economic development efforts; and (3) provided high-quality services to manufacturing businesses to sustain and grow operations in the region.

Regional partner respondents also agreed that colleges (1) attracted talent into the manufacturing field through technical training; (2) helped manufacturers to thrive by providing various support services in addition to training and education; and (3) broadened the technician talent pool by recruiting women and people of color and by assisting low-wage earners, veterans, and formerly incarcerated people in accessing well-paying jobs in manufacturing.

Respondents agreed that in their regions as a whole, (1) manufacturers who invested in technician education and training were supported; (2) innovative and productive manufacturing firms were supported; and (3) there is innovation, production, and inclusivity of women, people of color, and groups with barriers to employment. For more details on the results of the survey, see Appendix V.

Interview Findings

In addition to the survey, in-depth interviews were conducted with colleges' regional economic development partners. (See Appendix VI for more detail.) Respondents were asked about both their perceptions of the role of their community college partner in their region's economic development ecosystem and about the inner workings of their relationship with the college. They were also asked about their organization's working definition of economic development and their organization's role within the context of that definition.

Table 3.1 reveals a sample of regional economic development partners' answers to two questions from our interviews that pertain to their organization's definition of economic development and their perception of their own role as it relates to that definition. Among the definitions offered by regional partners, there is broad acknowledgment of the central role played by workforce development in economic development strategies, and even of a growing urgency around its importance. Yet, there are also tensions, with some regional partners conceptualizing workforce development efforts as a discrete subset of economic development work and with many partners not directly reflecting the integration of those spheres in their own contributions and work. While workforce development shows up clearly as conceptually integral to definitions of economic development for regional economic development partners in this sample, how it fits in systematically and strategically to the traditional suite of economic development activities and strategies at the regional level is still emerging.

Table 3.1. Select Responses to Interview Questions About Economic Development,
by Regional Economic Development Partners

Interview Question 1	Interview Question 2
How do you define economic development (ED)? What kinds of activities does it entail?	How does your organization contribute to economic development?
Supporting businesses to grow the community and make it more successful	Coordinates ED for county, business services, and retention; new priority is talent retention in the region
Identifying opportunities for growth that bring a certain number of jobs at a certain wage level and include capital expenditure by the incoming firm(s); overlaps with workforce development but is not entirely synonymous, as they have workforce development efforts focused on stability instead of marginal growth	State development agency: business development/recruitment (connect with workforce ecosystem, including colleges); workforce strategy (working groups; new programs/ideas around strategy development and deployment, support companies' and colleges' workforce planning); infrastructure (broadband, etc.)
Job creation, good-paying jobs, better-skilled jobs	NA
Increase in tax base, lowering poverty, creating quality jobs, increase median income of region	Coordinate business recruitment; engagement with relevant regional entities, especially export-oriented firms; research-based approach to identifying competitive gaps and opportunities
Thriving communities	Lift up voice of manufacturers, among the firms themselves and with community leaders; articulate their impact
Create family-sustaining jobs; serve employers so they can create jobs, provide support services to communities	Coordinate between investor companies/HR functions and workforce partners, including the community college
Growing tax base and job opportunities	Business recruitment and assisting existing businesses, but also quality of life in the region, housing—all parts of talent attraction, workforce that are important among employer partners

Approaches to Community College Engagement in Regional Economic Development: A Typology

The survey and interview results described above, considered in conjunction with insights derived from the colleges and their employer partners, allowed us to assess the role of the eight case study colleges in their economic development ecosystems. In analyzing community colleges' regional economic development activities alongside feedback from both their employer and economic development partners, we gained an ecosystem-wide perspective.

We identified four broad approaches to economic development processes across the three levels of engagement introduced by the HII conceptual model (student, firm, and region). Each approach reflects a different strategic lens on the primary or appropriate role of community colleges in economic development and varying ideas about the fundamental drivers of economic growth.

Figure 3.1. A Typology of Approaches to Economic Development for
Community Colleges and the HII Conceptual Model
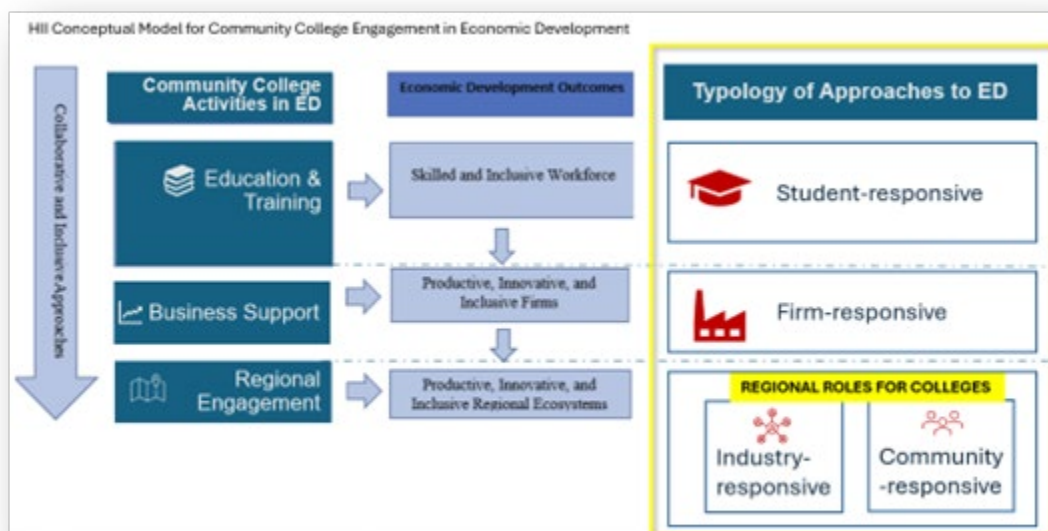
Figure 3.1 illustrates how the typology of approaches maps onto the levels of community college engagement in economic development as put forward by the HII conceptual model. The typology includes a student-responsive approach, which can be thought about alongside the education-and-training-activity stratum in the model; a firm-responsive approach, which maps onto the business-support stratum; and two additional approaches identified as regional in nature—industry-responsive and community-responsive approaches. These final two approaches align

with the regional-engagement stratum of economic development activity for colleges in the HII conceptual model, and they are our focus in our elaboration of the typology in this chapter.

The approaches describe the contexts in which community colleges operate by characterizing how economic development ecosystem actors individually and collectively perceive the role of community colleges, including the colleges themselves. These approaches are not descriptions of any given college's comprehensive approach. Instead, they represent both functional interdependencies of the work *all* colleges do to some degree, as well as different ways for thinking about *how* colleges go about that work at the regional level (or not) in their economic development ecosystems. Further, these approaches are not conceptualized as mutually exclusive; in reality, most community colleges serve multiple, crosscutting roles simultaneously to varying degrees, sometimes located in different workstreams of the college that, in turn, take on different strategic orientations to regional economic development. Finally, these characterizations have been synthesized specifically for the community college role in economic development as it pertains to technician education programs directed at regional manufacturing sectors. While the typology may lend insight into broader trends around the community college role in regional economic development, the scope and purview of what this chapter can say on that topic is constrained to the context of advanced technological education for manufacturing-related careers.

Of these four approaches, two reflect a focus on the labor-demand side of the regional economy, and two focus on the labor-supply side. On the labor-demand side, colleges may take a firm-responsive approach that centers the needs of individual firms, or an industry-responsive approach that responds to the shared needs of firms on the collective level of industry. On the labor-supply side, student-responsive approaches center the needs of individual students/workers, and community-responsive approaches take a collective-worker or community-oriented perspective. Notwithstanding the interdependence of the different roles that community colleges play, the typology aims to articulate the variation in assumptions made by ecosystem actors about the predominant or optimal focus of community colleges in regional economic development. (See Figure 3.2 for a summary visual.) We discuss the ways in which the ATE community might interpret and use this typology in the next section of this chapter.

Finally, it is important to remember that the community college role is shaped and limited by several factors. Community colleges are often not the most powerful actors in their economic development ecosystems—their power is limited in terms of both resources and varying levels of state support, as well as by the underlying assumptions held by both colleges themselves and their fellow ecosystem actors regarding which entities have the most leverage in the dynamics of regional economic growth. The typology presented provides a framework for understanding the diversity of the roles that community colleges *can* play in economic development, and in many instances already do, though they may not be widely acknowledged for it.
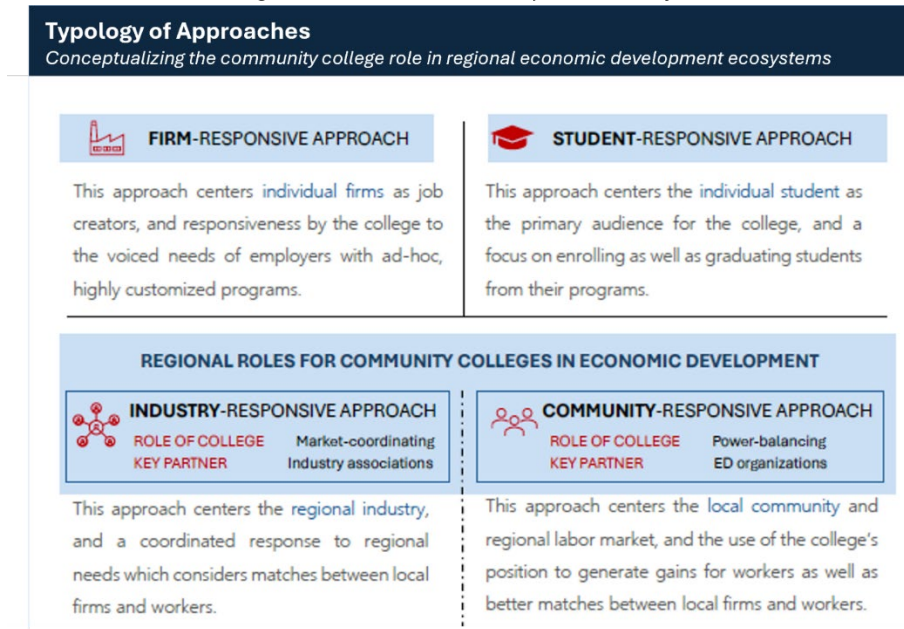
Figure 3.2. Typology of Approaches to the Role of Community Colleges
in Regional Economic Development Ecosystems

Typology of Approaches
Conceptualizing the community college role in regional economic development ecosystems

FIRM-RESPONSIVE APPROACH

This approach centers individual firms as job creators, and responsiveness by the college to the voiced needs of employers with ad-hoc, highly customized programs.

STUDENT-RESPONSIVE APPROACH

This approach centers the individual student as the primary audience for the college, and a focus on enrolling as well as graduating students from their programs.

REGIONAL ROLES FOR COMMUNITY COLLEGES IN ECONOMIC DEVELOPMENT

INDUSTRY-RESPONSIVE APPROACH
ROLE OF COLLEGE Market-coordinating
KEY PARTNER Industry associations

This approach centers the regional industry, and a coordinated response to regional needs which considers matches between local firms and workers.

COMMUNITY-RESPONSIVE APPROACH
ROLE OF COLLEGE Power-balancing
KEY PARTNER ED organizations

This approach centers the local community and regional labor market, and the use of the college's position to generate gains for workers as well as better matches between local firms and workers.

Student-Responsive Approach

The student-responsive approach is grounded in the idea that the primary way community colleges engage in economic development is by responding to the needs of students—by enrolling and graduating them from their programs and using metrics like enrollment and completion rates as their foremost metrics of success. This approach primarily relies on individual students to connect the dots between education and employment in the regional economy. Nevertheless, enrollment remains a vitally important dimension of the community college role—both to the sustainability of community colleges and to the maintenance of the regional talent pipeline so crucial for employers. For example, innovative enrollment strategies have important equity implications as community colleges work with CBOs to enroll students from underserved populations. Additionally, enrollment dynamics have become increasingly complex due to shifting demographic trends, including an aging population and brain drain in regions suffering continual out-migration. While these trends are important, a student-responsive approach as an orientation to regional economic development implies a comparatively narrow purview for community colleges insofar as student enrollment and completion processes are not strategically integrated within the broader economic development processes, networks, and institutions of the region.

Firm-Responsive Approach

The firm-responsive approach focuses on the individual firm as the organizing principle for economic development strategies and centers firm-oriented responsiveness as the primary role for other ecosystem actors, including community colleges. Because this paradigm conceptualizes individual firms as job creators and the

ultimate drivers of growth, the appropriate role for community colleges within it is to actively and efficiently respond to firms' articulated needs, meeting them with customized programs and services. Unlike in the student-responsive approach, the firm-responsive approach does feature a more active role for community colleges in regional economic development; moreover, strong partnerships with regional employers have long been foundational to successful technician education programming. Yet, the firm-responsive approach as described here doesn't present a strategic pathway for community colleges to engage with their regional economic development ecosystems beyond fulfilling individual firm requests on a generally ad hoc, as-needed basis.

Regional Approaches

At the level of the region, we identified two strategic approaches to economic development that interact to produce both synergies and tensions: industry-responsive and community-responsive. Most community colleges engaged in economic development at the regional level, including all eight of the colleges in this study, implement dimensions of both approaches.

Industry-responsive Approach

The organizing principle of the industry-responsive approach is a focus on the collective industry, not individual firms, and thus its purview is regional.[3] Economic development strategies in this paradigm are designed to cultivate an ecosystem of necessary inputs for regional industry growth, and individual firms' needs are one input of many. Firms are members of (ideally, coordinated) industries, and industry is one actor within a regional economic development ecosystem. The community college is viewed as another actor in that broad ecosystem, and its role is to serve the needs of the regional industry. The process of defining industry needs is a necessarily collaborative one in an uncoordinated market like the United States. Thus, in this paradigm, community colleges must inevitably negotiate individual firms' skill demands and coordinate the efforts of multiple actors to generate viable, sustainable matches between firms and workers in the regional labor market. Organizations such as industry associations that help cohere the regional industry landscape are uniquely helpful partners to community colleges in that work. Notably, the relative importance of educational institutions in industrial growth strategies is rising as supply-side inputs like workers' skills are perceived as an increasingly important determinant. Though this shift in focus to workers' skills has potential implications for greater equity in economic development strategies, mandates around inclusivity in this industry-responsive approach are secondary to goals pertaining to industry growth.

Community-responsive Approach

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[3] McCann, P., & Oort, F. (2019). Theories of agglomeration and regional economic growth: A historical review. In R. Capello and P. Nijkamp (Eds.), *Handbook of regional growth and development theories* (pp. 6–23). Edward Elgar Publishing. https://doi.org/10.4337/9781788970020.00007

The community-responsive approach centers the regional labor market and, with it, the needs of its workers, including the most vulnerable workers. This regional approach conceives of the role for community colleges similarly to how it is constructed within the industry-responsive paradigm, but here colleges take on a coordinating, collaborative, and regional role intentionally and explicitly from the perspective of gains for workers. In this paradigm, regional industry growth and equitable distribution of that growth are intertwined goals that are pursued simultaneously. Community colleges taking a community-responsive approach are not just focused on viable matches between workers and firms that contribute to regional industry growth; they are explicitly in pursuit of better matches *as defined by workers*. Regional economic development organizations (EDOs), including public or quasi-public ones, can be particularly helpful partners to community colleges in implementing this approach, empowering them to focus on workers' gains alongside pressures to prioritize industry needs. In the community-responsive approach, the community college role is conceptualized as leveraging its unique position on behalf of workers in a power-balancing act within the broader industry ecosystem.

Reflecting on the Typology: Community Colleges as Regional Players and the Implications for the ATE Community

All eight community colleges in this study had explicit industry-oriented mandates and were intentionally selected as best-in-class programs in relatively well-functioning economic development ecosystems. This is important context for understanding how the typology's theorized approaches are reflected within and across the eight cases. From a functional perspective, **all community colleges in this study reflect elements of all four approaches in some aspect of their work**. Moreover, some of the approaches entail clear functional interdependencies; the student-responsive and firm-responsive roles for community colleges could be thought about as foundational to community- and industry-responsive ones, respectively. Yet, this typology can also be viewed through the lens of strategic orientation. Using it as such, the eight colleges in this study, as field-leading institutions, reflect in their approach a strategic focus on their regional industry sectors (i.e., industry-responsive approaches) and their regional labor markets or communities (i.e., community-responsive approaches), to varying degrees.

Given the regional mandate reflected in ATE grants, our analysis assesses how the eight community colleges in our study filled their industry-responsive and community-responsive roles, participating as distinctly regional actors. There are implications here for all community colleges regardless of the type of ecosystem in which they are situated, including guidance on what college leadership can do to nudge their home ecosystems in the direction of equitable growth. It is important to emphasize that the descriptions herein of community college roles in industry-responsive and community-responsive approaches are non-comprehensive and do not represent all of the important roles that community colleges play in either paradigm.

For each of the typology's two regional approaches, we highlight one strategic role played uniquely by community colleges as well as associated activities implemented by the colleges and their key partners. (See Figure 3.3.) For the industry-responsive approach, we highlight a market-coordination role for community colleges on behalf of industry and industry associations as key partners in that work. Industry-specific employer

associations, if present, can be uniquely helpful in shifting colleges' focus toward regional industry needs and away from isolated, individual firm needs. For community-responsive approaches, we highlight a vetting and advocacy role for colleges on behalf of workers and public or quasi-public economic development partners as pivotal in their support for the prioritizing of workers' outcomes vis-à-vis industry needs. In reflecting on how this typology translates into practice, we offer illustrative examples from across the case study colleges where these strategic roles were operationalized effectively.

Figure 3.3. Sample Activities for Industry-Responsive and Community-Responsive Approaches to Regional Economic Development

The Industry-Responsive Approach: A Market-Coordinating Role for Community Colleges

Given the uncoordinated market of the United States, **community colleges play a market-coordination role in economic development by acting as a unique lynchpin between economic and workforce development institutions.** As the most direct institutional linkage between labor supply via training systems and labor demand from employers, community colleges lay the groundwork for more efficient, productive, and innovative regional economies that are increasingly reliant on skill upgrading to compete globally (Porter, 2000). To play this important

role in an industry-responsive approach, colleges must make one major shift in their strategic focus: a move from thinking in terms of serving the needs of individual employers to thinking in terms of serving the needs of regional industries. Their most effective strategies will directly engage industry-wide actors, including regional industry associations where they are present.

In a market-coordinating role, community colleges prioritize the transferability of skills across firms within an industry and facilitate linkages among employers in the regional sector. They also coordinate with other community colleges in cultivating the regional labor market (e.g., by building shared curricula for regionally relevant skills and credentials and collaborating on regional industry-engagement activities). In this role, colleges endeavor to think not simply about the firms that comprise their regional industry but more foundationally about the innovative processes that underlie the regional sector's competitiveness and potential for growth. Community college leadership may consider regional innovation processes, for example, in the context of decision-making around college investments in particular industry-related equipment. The more community colleges can coordinate and collaborate on their investment decisions, training and credentialing strategies, and other industry-related activities, the more they can collectively meet the immediate needs of their regional industries and strategize around the longer-term opportunities and challenges they face.

All community colleges across our eight sites played a market-coordinating role, to varying degrees. One illustrative example is the partnership between Maricopa Community Colleges, including Mesa and Estrella Mountain, and the Arizona Commerce Authority (ACA). This partnership led to the development of the AATN (of which Pima—another case study college located in Arizona but not in Maricopa County—is also a part) and spaces like AzAMI at Mesa; both of these interventions created strategic entry points for industry into training infrastructure and with regional talent pools. The ACA provided the Maricopa Community Colleges with seed funding for industry-relevant equipment as an incentive to align industry-informed curricula across the county's colleges in the absence of a statewide curricular catalog. The colleges coordinated to train workers in industry-relevant skills with the goal of meeting roughly 80 percent of any one firm's skill requirements for new employees. This partnership exemplifies a community college's use of both an intentional industry-oriented lens and a regional perspective, as well as a clear prioritization of transferable skills and inter-college coordination around regional industry needs.

Other good examples of colleges performing a market-coordination role from our sample include Lorain's active facilitation of linkages among employers in their regional industry sector, as well as their consideration of regional innovation processes in identifying strategic investments in training equipment. Additionally, the collaboration among Ohio's community colleges (including Lorain and Columbus State) for a coordinated response to Intel's talent needs, and Daytona State's work with regional manufacturers on their FAME program, both demonstrate how community colleges play the market-coordination role key to an industry-responsive approach. Chapter 1 of this report, *College Activities and Strategies*, showcased in greater detail

other activities implemented by community colleges that are foundational to an industry-focused paradigm. For example, the variation seen in the colleges' industry-oriented, work-based learning activities (e.g., earn-and-learn models, apprenticeships, and internships/co-ops) illustrates the diversity of ways community colleges meet industry needs with regionally specific interventions.

Many community college technician education programs have a mandate to be responsive to industry at a regional level through their different dedicated funding streams, but they cannot fulfill that mandate without the active participation of individual employers. Individual employer engagement, both with partnering colleges and with other firms in the regional industry, can take many forms. Employers engage colleges and other firms through college-hosted advisory boards; they host college interns or provide other opportunities for hands-on experience in industry-tailored programs; they contribute to and use open-source, adaptable curriculum to train their workers; and they prioritize transferable, high-value credentials in the regional labor market. Chapter 2, *Employer Contributions*, explored the many ways employers in this study engaged with their partnering colleges, including through activities that helped cohere their regional industry. We found that most employer partners participated in active advisory boards hosted by community colleges, whereas the collaborative creation and use of shared curricula among regional employers was more varied.

Table 3.2 summarizes some of the most important ways employers engaged partnering colleges that are relevant to an industry-responsive approach. The motivations articulated in the table reflect a few notable insights; one of the most important is that an industry orientation is in the nascent stages among many employers. Firms are still in the process of internalizing and operationalizing the extent to which their interests and competitive advantages are *a function of* those of the regional sector as opposed to being *in competition with* them. Relatedly, another key insight is employers' corroboration of the claim that community colleges do, in fact, facilitate linkages among firms in the regional industry sector that otherwise might not exist. Finally, employers' feedback was somewhat in tension with community college respondents' claims about the degree to which colleges equip workers with workplace-ready skills. Employers discussed community colleges as *sourcing* talent and saw themselves as *shaping* talent, whereas colleges saw themselves as doing significant shaping of talent as well. Contrastingly, community colleges highlighted tensions in their ability to focus on industry needs amid vocal individual firm demands and emphasized that firms should expect to be responsible for at least a portion of their individual training requirements, including their associated costs.

Table 3.2: Employer Partners' Program Involvement and Motivation
(Excerpt from Chapter 2, Table 2.1)

Primary Employer Motivation	Firm Size	Type of Firm	Program Involvement Detail
Talent acquisition	Small	Electricity product manufacturer	Sponsors apprenticeship programs and mentorship; provides in-house training
Talent acquisition and community/industry orientation seeking inclusive growth	Large	Gas provider	Provides adjuncts
Talent acquisition and goal to lead and give back to community and industry	Small	Blade manufacturer	Participates in CNC, EMMT, AMT; provides adjuncts; serves on college board; contributed to new college facility
Talent acquisition and support for local industry	Unknown	Defense manufacturer	Participates in AIT; microcredentials; provides in-house training; board membership on multiple state and industry consortia
Talent acquisition and seeking to engage younger generations	Large	Appliance manufacturer	Involved in all relevant program development, including robotics; conducts required courses for employees; develops electromechanics apprenticeship
Develop regional industry and community with stronger community college talent pipeline and technology uptake	Small/growing	Electric manufacturer	MEMS certificates, associate and bachelor degrees, with earn-and-learn; strong advisory board and curriculum development involvement
Talent acquisition; seeking collective action by industry to address talent gaps	Small	Boat manufacturer	FAME, Founder of FAME
Collaboratively develop regional industry and community	Medium	Simulation hardware manufacturer	FAME; FAME board member; leads regional manufacturing association
Collaboratively develop regional industry and community to grow high-tech manufacturing in the region	Small	Niche lab and equipment manufacturer	FAME; Advanced Technology Center; chair of FAME board

Primary Employer Motivation	Firm Size	Type of Firm	Program Involvement Detail
Collaboratively develop local industry, supply chains, and community engagement with advanced technology focus	Large	Semiconductor and electronics manufacturer	QuickStart program; AIT; strong advisory board and curriculum development involvement; equipment provider; leads industry consortium
Develop regional industry and local community	Large	Aerospace manufacturer	AIT; involvement in AzAMI and state initiative; provides adjuncts
Develop national industry and local community with focus on advanced technology	Large	Influential semiconductor manufacturer	QuickStart program for semiconductor technician certificate; AIT; strong advisory board and curriculum development involvement; equipment provider; involvement in state initiative

To note, we have emphasized here our empirical findings in our specification of the community college role within an industry-responsive paradigm; the eight community colleges in this study are all, by virtue of particular funding streams, obliged to respond to industry, and thus we can more systematically evaluate the extent to which their activities and strategies reflected that orientation. Relatedly, we also assessed the extent to which other ecosystem partners corroborated industry responsiveness on the part of the community college, and whether the partners themselves reflected an industry orientation. In contrast, responsiveness to the regional labor market at the community level is a developing emergent trend within our empirical findings and suggests an avenue for future research.

Many questions remain for practice and research around how community colleges play a market-coordinating role in their regional economic development ecosystems. For example, what are the most effective ways community colleges coordinate their regional industry landscape in order to rationalize regional talent needs? Are there certain compositional factors of regional industry sectors that make them more amenable to community college coordination? As funders of skill building at the regional level, how do community colleges play a strategic role in negotiating the relative cost burdens of the regional industry on one hand and the state on the other? These questions, among others, provide productive starting points for future research on the role of community colleges in responding to manufacturing-related industry needs within their regional economic development ecosystems.

The Community-Responsive Approach: Community Colleges as Community Vetting Mechanisms for Economic Development Strategies

Given their legacy missions, community colleges serve their local communities. Faculty and administrators have a front row seat to observe which economic development strategies work in reality and which don't. By leveraging

their position in economic development ecosystems on behalf of students and workers, community colleges test theories of inclusive economic development, demonstrating if and how targeted training interventions reliably lead to economic opportunity for workers and decrease inequality in regions over time. This role requires a shift in frame on the part of community colleges from an exclusionary focus on meeting regional industry talent needs in the context of a growth-first approach to an equal consideration of the *quality* of labor market matches for workers—a perspective that views growth and equity as intertwined dimensions of any economic development strategy.

To take on this role, community colleges actively seek to balance power dynamics among actors in their regional economic development ecosystems, which have historically reflected an emphasis on the needs of firms and industries as generators of growth as opposed to those of workers and communities. (See the US Chamber of Commerce Foundation's Talent Pipeline Management framework as an example.) **Given the unique ways in which community colleges shape the regional labor market as well as the configuration of credentials within it, colleges can work to intentionally consider the interests of workers alongside the interests of employers.** Community colleges' closest partners in that work are typically regional economic development partners, especially public or quasi-public entities, alongside whom they advocate for higher firm investments in regional training, higher starting wages for workers, and wage growth, as well as professional development opportunities for workers over time. They may also coordinate with other community colleges on that agenda as a collective front, advocating for better worker outcomes across the regional labor market. In addition, community colleges partner with public-sector entities to support vulnerable and underrepresented workers, in some instances through the provision of public services, including wraparound services tailored to the needs of students. In their engagement with firms, community colleges take on this role by leveraging their relationships with employers to increase starting wages post-graduation and make more transparent wage trajectories over time; colleges are also selective about catering to those employers who invest in creating the highest quality, most accessible jobs possible. Finally, they engage community-based entities in both outreach efforts and long-term, strategic planning.

Our study provided many examples of community colleges implementing community-responsive approaches, leveraging their position to prioritize better matches in the labor market for students and workers. The approach to economic development reflected in the ongoing work at Pima in Arizona provides one excellent example. Prior to the development of a competitive manufacturing sector in their region, Pima developed an intentional and explicitly articulated framework for their participation in regional economic development strategies that insisted on high-wage pathways and a collaborative approach to industry engagement. Pima also leveraged colocation strategies with their home county, which allowed them to deliver strong wraparound services to more vulnerable workers and to prioritize nontraditional students, including adult learners and incumbent workers. In Ohio, Lorain focused on the issue of family-sustaining wages in their advising of students and on extensive, large-scale engagement of the local community in their institutional strategic planning processes. Respondents from both Lorain and Mesa discussed actively pushing back on their employer partners around the experience requirements of entry-level positions and on starting wage levels. Similarly, Clark State in Ohio was selective about the employers with whom they worked. Several of the colleges centered innovative approaches to inclusion that targeted structurally disadvantaged

communities specific to the dynamics of their regional labor markets: Gateway notably targeted individuals who had been involved with the criminal justice system, and Clark State integrated a nuanced lens on addiction into their approach to economic development. Finally, most of the sites in this study emphasized the importance of catering to nontraditional student populations, including adult learners.

In a community-responsive paradigm, regional economic development partners establish close relationships with local community colleges and work together to align their respective goals with shared public mandates. In this approach, community colleges and public-sector entities may deploy colocation strategies and work together on interfacing with the community, including in the delivery of supportive services. Public or quasi-public regional economic development entities in a community-responsive approach can elevate firms' commitments to hiring targets and starting wage levels, both in their private relationships with employers and in the public discourse. They can also specify and make transparent the training-related investments and supports from employers required to meet employers' DEI goals and publicly stated expansion commitments.

Community colleges are critical sites for understanding the distributive dimensions of economic development and the persistent challenges. Community colleges serve as conduits for workers' interests in a way that is unique to the United States, given the relative weakness of organized labor and workers' organizations in economic development policy as compared with the rest of the Global North. In this context of lacking worker representation, how do community colleges serve the function of ascertaining or validating workers' evolving needs, and how might they do that work more effectively? Where are the persistent, underacknowledged tensions in economic development strategies, and how can they be more effectively acknowledged and addressed, including by community colleges? As vital training institutions for a majority of American workers, and as the primary interlocutors for employers' regional skills demands, there is a role for community colleges in advocating for workers and investments in workers; what that role looks like or can look like in different economic development ecosystems remains an open question for future research.

Implications for ATE and the Wider Community College Practitioner Community

Generative interdependencies, synergies, and tensions across all four of the approaches in this typology can be used by the ATE community to further explore the complexities of the roles played by community colleges in economic development. This typology provides a way of understanding the multiple functional roles community colleges often simultaneously play across their diverse workstreams. As educational institutions, all community colleges dedicate significant resources to responding to students; thus, they all evaluate their success at least in part through the lens of student-oriented metrics. Thus, from a functional perspective, the student-responsive approach clearly undergirds the other three. Similarly, a responsiveness to firms functionally undergirds responsiveness to industry as industries are made up of firms, and a responsiveness to labor markets at the community level could be viewed as an aggregation or an optimization of the other three approaches. The functional perspective is important for understanding the complex interactions both among the different

workstreams and funding streams of community colleges, and among the different strategies that layer onto them and get carried out by different and often siloed parts of the college.

This typology is also conceptualized as a way of understanding predominant ideas among ecosystem actors of the optimal role(s) for community colleges in regional economic development strategies. As such, the typology reflects four different prioritization schemes that entail tensions as well as synergies. For example, a firm-responsive paradigm is in tension with an industry-responsive one, insofar as community colleges engage individual firms as members of broader industry communities or as single actors whom they serve independently. These are different lenses for how community colleges strategically engage their employer partners. Likewise, a comparison of industry-responsive to community-responsive approaches reveals both tensions and synergies. These approaches can be synergistic—as industry growth is achieved via industry-responsive strategies, community colleges can layer on a worker-oriented, community-driven lens. However, in our conceptualization of community-responsive approaches, we describe an actively dual, simultaneous consideration of industry needs alongside gains for workers. In reality, industry growth does not necessarily translate into worker and community gains, and moreover, colleges can pursue community-responsive approaches in the context of small or slow-growing regional industries. In these cases, community-responsive approaches may be implemented before or possibly in tension with industry-responsive approaches.

The two approaches that feature community colleges as regional players in economic development ecosystems— industry-responsive and community-responsive approaches—are in line with significant and persistent trends in the wider world of economic development. The last decade has seen greater market coordination in the fields of economic and workforce development, raising the strategic importance of regional, market-level actors. American firms are responding to a global plane of competition on which firms must compete as sectors for increasingly high-skill niches in global industrial value chains.[4] Relatedly, the move by workforce development entities, including community colleges, away from responding to individual firms and toward meeting industry needs has been developing into standard practice, as exemplified in the requirements of federal grants like ATE. Alongside these developments, community colleges have themselves redefined their most important markers of success, shifting their focus from enrollment rates to completion metrics to, now, post-graduation success of students in the labor market. (See the Aspen Institute's work on the Community College 3.0 Framework.) Amid this gradual shift of American economic and workforce development systems toward an industry sector and labor market orientation, an increasing trend of responsiveness to underemployed segments of regional communities on the part of community colleges is emergent and worthy of further investigation based on our findings.

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[4] Porter, M. E. (2000). Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly*, *14*(1), 15–34. https://doi.org/10.1177/089124240001400105

These developments highlight important dimensions of the community college role in economic development ecosystems. For one, the role of community colleges is inherently regional in industry-responsive and community-responsive paradigms, as industry sectors and labor markets take shape at the regional level. For community colleges to engage in these approaches, they must be empowered as regionally relevant economic development actors. While most economic development ecosystems across the United States likely do not reflect consensus around community colleges as such, there are clear opportunities for all community colleges to nudge their respective ecosystems toward more competitive regional industry sectors and/or more efficient and equitable regional labor markets. Our cases illustrate how community colleges can leverage both industry- and community-responsive approaches to take advantage of those opportunities.

Community colleges empowered to be responsive to industry are equipped with a nuanced understanding of industry dynamics, a distinctly regional perspective on their work, and institutional capacity for regional coordination. The result is more globally competitive regional manufacturing sectors and more resilient communities. Further opportunity accompanies a shift in perspective from thinking solely about industries and their needs to thinking simultaneously about labor markets and workers' needs at the community level (i.e., the consideration of a community-responsive approaches alongside industry-responsive ones). This shift bears on the extent to which regional economic development strategy directly ties growth to equity. Community colleges empowered to be responsive to labor markets consider distributive dimensions to be logically foundational to economic development strategies. Ideally, they are equipped with the data, resources, and institutional power to not only consider but look beyond industry needs in order to apprehend workers' gains in their engagement with their regional economic development ecosystems.

In practice, community colleges engaged in their regional economic development ecosystems will implement dimensions of both regional approaches to economic development outlined here, negotiating responsiveness to regional industry and to the communities that power it. These two regional approaches reflect the real-world tensions that arise in economic development processes, and community colleges can use the typology to think through them as they navigate their multidimensional roles.

Conclusion

The typology presented in this chapter reveals and explores multiple dimensions of the community college role in economic development ecosystems. Its goal is not to characterize any one economic development ecosystem with precision or authority; core dynamics of economic development ecosystems are not only difficult to stably characterize but also vulnerable to significant shifts based on circumstantial changes, including changes in institutional leadership and broad macroeconomic trends in regions. Alternatively, and going beyond binary conceptualizations of community colleges as "dual customer" institutions, the typology aims to open up the discourse on the community college role in regional economic development ecosystems to allow for a more nuanced understanding of (1) the multiple, interdependent, conflicting, and synergistic roles community colleges play, (2) the various and influential conceptions among their ecosystem partners of their optimal role; and (3) the

possibilities and options that exist if community colleges are empowered as regionally relevant actors in economic development strategies.

More specifically, this chapter has explored two major shifts in thinking about the work of community colleges in regional economic development: one from a focus on firms to a focus on industries (an industry-responsive approach), and the other, from a focus on industries to a focus on regional labor markets (a community-responsive approach). These shifts in strategy help to more directly link community college training to empirical outcomes for firms, industries, workers, and regional labor markets as well as the communities that comprise them. For firms and industries, the work of community colleges could help us better understand the relationship between targeted technician training and regional industry innovation as the US government makes historic investments to again be home to a globally competitive manufacturing base.[5] For families and communities across the United States, whether training in advanced technologies leads reliably to family-sustaining wages and reduced inequality is of enormous consequence.[6]

These realities highlight both the unique and strategically important position of community colleges as the primary innovators of skill building in the US context as well as the high-stakes outcomes to which that work is tethered, both in terms of policymaking and academic research. Ultimately, how community colleges act (as market coordinators in industry-responsive approaches, or as vetting mechanisms for inclusive economic development schemes in community-responsive approaches), takes shape through and is grounded in their work as well as their expertise in training. Economic development ecosystems do best when they resource as well as consult community colleges as a vital source of expertise and a crucible for innovation. Additionally, community colleges as public-sector institutions are either funded and empowered to play these strategic roles as market coordinators, advocates for workers, and innovators of skill building or they are not; both are deliberate choices with contrasting outcomes for regions.

Finally, this analysis underscores the reality that different paradigmatic approaches to economic development reflect different strategic priorities and roles for community colleges that may involve various tensions and tradeoffs. Further, the work of economic and workforce development generally confronts a variety of competing interests, including fundamental conflicts between the interests of workers and those of firms—which is not to say they are never aligned. Practitioners and policymakers are best served when those tensions are openly acknowledged and addressed so that community colleges can be adequately equipped to navigate them. Community colleges are dynamic organizations that play multiple strategic roles in economic development

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[5] Tallman, S., Jenkins, M., Henry, N., & Pinch, S. (2004). Knowledge, clusters, and competitive advantage. *The Academy of Management Review, 29*(2), 258–271. https://doi.org/10.5465/amr.2004.12736089

[6] Ornston, D. (2014). When the high road becomes the low road: The limits of high-technology competition in Finland. *Review of Policy Research, 31*(5), 454–477. http://doi.org/10.1111/ropr.12091

ecosystems; this analysis has conceptualized the variety of options community colleges have in approaching those roles and some ways other ecosystem actors can support colleges in them.

Discussion

This report has illuminated the unique roles community colleges play in economic development ecosystems nationwide. Building on the conceptual model, it has explored three distinct but interconnected perspectives on the nuances of those roles: the college perspective, the employer perspective, and the regional economic development partner perspective. (See Figure 1.)

Figure 1. HII Conceptual Model & Report Structure
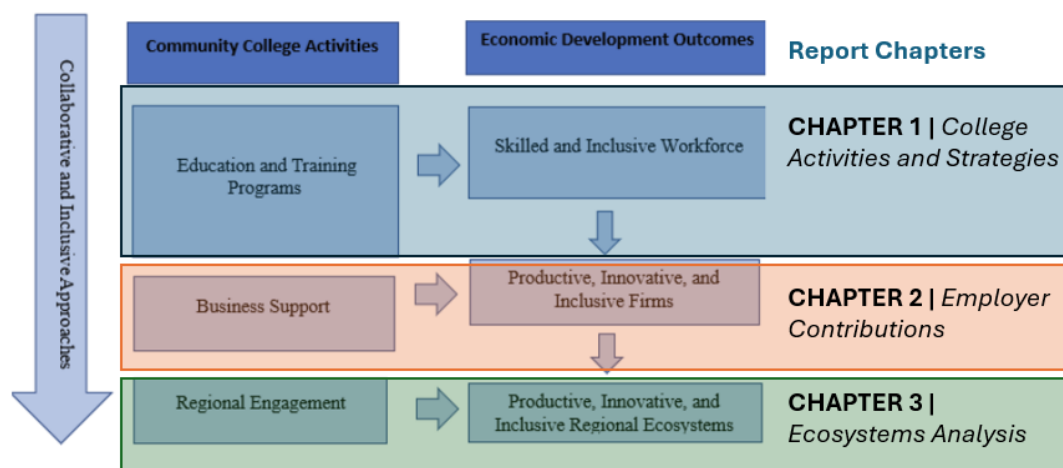
This figure illustrates how this report, including its three substantive chapters, builds on the HII conceptual model.

From Conceptual Model to Empirics

The analysis produced a checklist of the economic development activities implemented by the eight case study colleges in this study, across the three types of activities that colleges implement in their economic development ecosystems according to the HII conceptual model. (See Figure 2.) Employer insights were then used to reflect on those activities and strategies from the perspectives of colleges' foremost partner and client.

Figure 2. HII Conceptual Model & Chapter 1's Activities Checklist

HII Conceptual Model for Community College Engagement in Economic Development
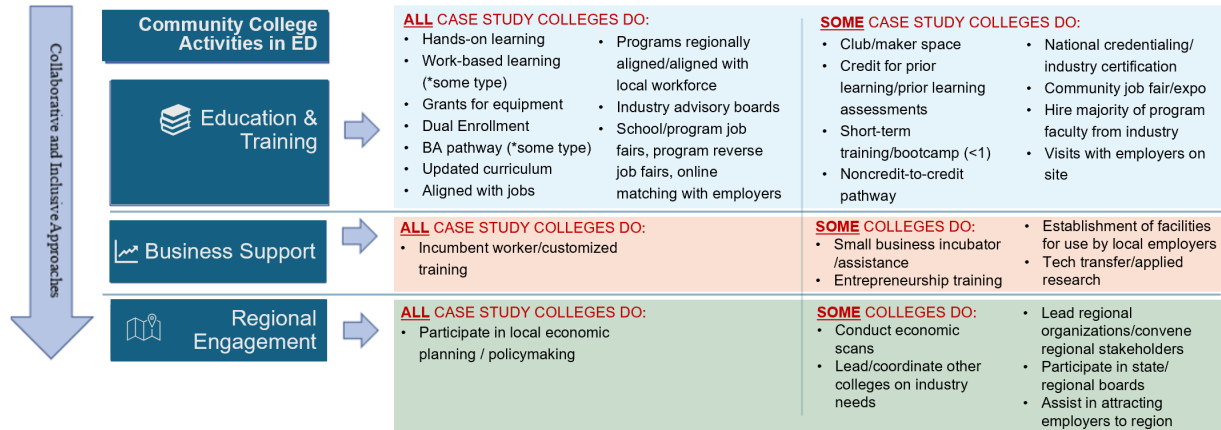
Caption (Fig. 2): Building on the HII conceptual model, Figure 2 illustrates the activities the eight colleges implement organized by activity type and whether all or some colleges implement a particular activity.

Additionally, four strategic approaches to economic development were identified across the three levels of college engagement in economic development proposed by the HII conceptual model. (See Figures 3 and 4.) Those identified approaches were student-responsive approaches, firm-responsive approaches, and two regional approaches: industry-responsive and community-responsive approaches. Regional approaches and regional roles for community colleges in economic development were the focus of our analysis, and the report details the many ways colleges go about their economic development activities with a regional and strategic lens (e.g., collaborative curricula, work-based learning that directly engages regional industry, and college-hosted hubs for employers and communities).

Figure 3. HII Conceptual Model & Chapter 3's Typology of Approaches

HII Conceptual Model for Community College Engagement in Economic Development
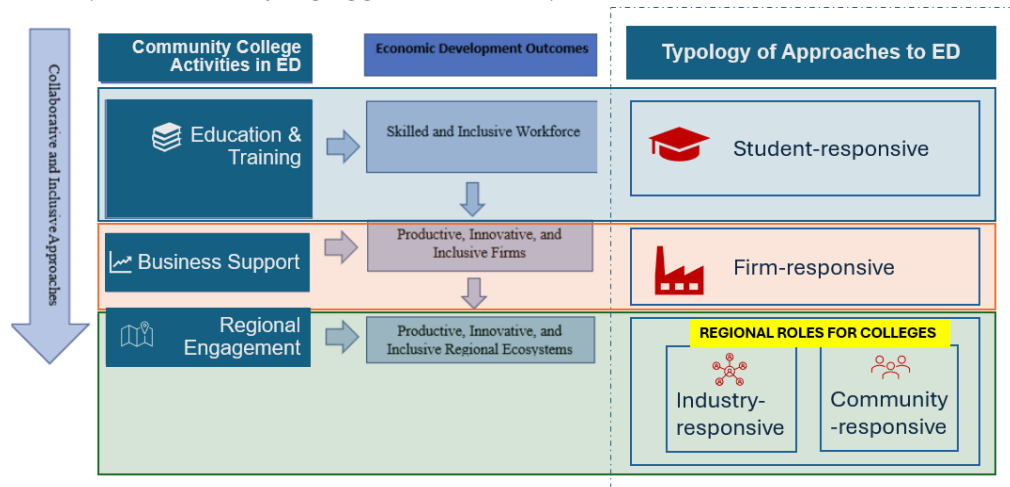
This figure connects the approaches to community college engagement in economic development identified in Chapter 3 to the HII conceptual model, highlighting those approaches that represent regional roles for colleges.

Figure 4. A Typology of Approaches for Community College Engagement in Economic Development (Excerpt from Chapter 3)

FIRM-RESPONSIVE APPROACH

This approach centers individual firms as job creators, and responsiveness by the college to the voiced needs of employers with ad-hoc, highly customized programs.

STUDENT-RESPONSIVE APPROACH

This approach centers the individual student as the primary audience for the college, and a focus on enrolling as well as graduating students from their programs.

REGIONAL ROLES FOR COMMUNITY COLLEGES IN ECONOMIC DEVELOPMENT

INDUSTRY-RESPONSIVE APPROACH

ROLE OF COLLEGE   Market-coordinating
KEY PARTNER   Industry associations

This approach centers the regional industry, and a coordinated response to regional needs which considers matches between local firms and workers.

COMMUNITY-RESPONSIVE APPROACH

ROLE OF COLLEGE   Power-balancing
KEY PARTNER   ED organizations

This approach centers the local community and regional labor market, and the use of the college's position to generate gains for workers as well as better matches between local firms and workers.

This figure offers a snapshot of the typology of approaches to economic development for community colleges explored in Chapter 3.

Based on those inputs and analyses, one significant finding reflected throughout the report is that community colleges, through their technician education programs, contribute in significant ways to the innovation capacity of regional manufacturing sectors across the United States.

and Recommendations

Ultimately, and as other scholars have noted (Lowe, Fitzgerald, Giloth, etc.), colleges act as strategic workforce intermediaries and dual customer institutions for both students/workers and employers, reflecting the increasing integration between economic and workforce development systems. So, how can this important role in economic development be enhanced in regions with the potential to cultivate high-tech manufacturing? This study indicates that continued progress requires both manufacturing-specific institutions and networks that connect colleges to each other, and program leaders strategically invested in delivering regional results that benefit students and employers.

Additionally, the economic development roles performed by community colleges reflect important, persistent trends we expect to continue: the relevance of sector-based workforce training models and the increasing significance of workers' skills to industry growth trajectories. This means the community college role in economic development is expected to only grow more significant, which entails increasing pressures and, in turn, demands increasing attention as well as resources. Finally, a critical aspect of our conceptual model has now been filled in: strategy matters. The college leader seeking to contribute to the advanced manufacturing sector must consider both industry and community needs as well as responses that deliver two important regional results: economically viable industries and sustainable communities.

The NSF ATE Program can be an indispensable pillar of support for this work. With a focus on regional results, it has the potential to be a springboard for the next generation of technician education strategies that advance the manufacturing sector. The NSF ATE Program generates and funds strategic opportunities across the country for actors within regional economic development ecosystems to convene and collaborate (e.g., educators, employers, and policymakers). These cross-sectoral channels of coordination directly contribute to regional economic development by cultivating more responsive, higher-skilled labor markets for more globally competitive manufacturing firms, more resilient regional economies, and a more productive United States. These potential contributions had not previously been documented, and no model was established for evaluation.

There is still much work to do to shift how employers and regional economic development organizations view their community college partners and how colleges contribute to technological change processes. This study clearly illustrates that case study colleges engaged systemically in economic development–related activities through several roles, regional in scale and strategic in nature; yet, where their contributions went underacknowledged, their capacities went underutilized. Amplifying and scaling the results of the NSF ATE program would enhance the important economic development work community colleges are doing and are uniquely positioned to do, strengthening regional manufacturing sectors and communities. In pursuit of that goal, this report concludes with six audience-specific recommendations for key stakeholders of the NSF ATE Program:

> **NSF ATE Program Administrators can use their convening power to help identify measurable outcomes that clearly evaluate and communicate ATE's contributions to regional economic development in terms that all parties understand and value.** This may include developing more refined guidance on relevant economic development metrics, including regional responsiveness to technological change, and manufacturing-specific indicators that would be useful for ATE program assessment. In particular, future research should investigate how ATE programming increases competitive advantage by developing specialization capacities in local manufacturing sectors through regionally specific skill-building schemes. Research-based and standardized guidance would help ATE program administrators evaluate their alignment with regional manufacturing strategies and ultimately claim the economic development outcomes to which their programs significantly contribute.

> **NSF ATE Program Investigators at community colleges can strengthen their regional engagement in economic development by embedding their efforts across all college workstreams, not simply in their technician education programs.** Grounding community colleges more actively in their regional economic development ecosystems stands to benefit not only ATE programs but other dimensions of the colleges' work, including pathways to bachelor's degrees. This can be done by integrating technical education program curriculum, faculty, and activities with the colleges' other programs, designing grant proposals with college stakeholders outside of the technician education programs, and engaging economic development actors with stakeholders across the college, especially college leadership. Technical education program administrators can serve as guides for colleges' more active engagement in their economic development ecosystems to the mutual benefit of ATE programs and community colleges writ large.

> **Community college leadership should prioritize engagement with economic development actors, including regional industry leaders, and find opportunities to institutionalize partnerships with them.** Community college leaders who are well-networked in their regional ecosystems not only elevate the standing of ATE programs but also are better positioned to leverage policy for the entire college's benefit. Physical spaces, co-founded by colleges and their industry partners, can play a unique role in solidifying colleges' economic development partnerships and in strengthening the regional ecosystem. State-subsidized industry-engagement hubs like the MEMS lab at Lorain and AzAMI at Mesa not only ensure training is aligned with industry needs and provide opportunities for firms' technological experimentation, but they contribute to the strategic integration of regional economic and workforce development systems. College presidents in particular, by supporting hubs like these and by directly engaging in the regional economic development ecosystem, can set a powerful example, strengthening ATE program outcomes as well as the college's impact footprint overall.

➢ **Employers should coordinate with other firms in their regional industry and champion their partnerships with community colleges.** By working to collectively articulate and invest in shared skill needs across their regional industry, employers can help build a strong regional labor market. This means actively participating in industry-wide forums like industry associations or industry advisory boards and co-investing in shared assets like open curricula for industry-relevant training and college-housed physical spaces where workers can train on cutting-edge technology. Employers that have long-standing experience with these activities in partnership with community colleges can serve as champions of their college partners, communicating their value to a wider audience and advocating for greater investment in them by other firms and the public sector. This research indicates that employer champions can facilitate the broader ecosystem's understanding of community college contributions, thereby reinforcing helpful institutional arrangements and unlocking potential for greater coordination.

➢ **Regional economic development organizations (EDOs) should adopt an approach to regional development that emphasizes the inputs of both the labor-supply (colleges) and labor-demand (industry) sides, as well as supports coordination between them.** Local economic development institutions can help ecosystem actors better understand their roles by developing a regional vision for economic development that values all inputs and understands the significant role workers' skills play in both industrial growth trajectories and regional competitive advantage. Local EDOs are well-positioned to support sectoral coordination and co-investments, not only by bringing together the labor-demand and labor-supply sides of the economy but also by supporting their respective coordination. For example, firms should be encouraged to coordinate their labor market needs by collectively investing in shared industry assets (e.g., open curricula; industry-wide hard assets, including brick-and-mortar spaces and technology). Likewise, community colleges can be better resourced to coordinate a collective response to industry-wide labor-demand and skill needs. Convening actors to align talent-development planning efforts at colleges and within firms is a key piece of this work that can be led by regional EDOs.

➢ **Similarly, state-level economic development organizations can facilitate coordination through financial subsidies and the establishment of statewide networks and programs.** For example, colleges in our sample located in Ohio and Arizona significantly benefited from programmatic infrastructure funded and managed by state-level entities. In Ohio, the publicly funded state-level organization Ohio TechNet, which co-locates with Lorain, connected community colleges implementing significant workforce development programs and provided grant-management training for their staff; additionally, state funding streams like Ohio TechCred subsidized incumbent worker training. In

Arizona, the Arizona Commerce Authority, a state-level economic development organization, was instrumental in the establishment of AzAMI and the AATN; both interventions helped connect community colleges to each other and industry and helped equip colleges to respond strategically to industry's changing skill demands. Programs like those in Ohio and Arizona intentionally use state funds to incentivize industry players to partner formally with community colleges. Looking ahead, while the role of state-level entities and programming in supporting community college engagement in economic development was not the focus of this report, our findings suggest it merits additional research.

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Appendices

Appendix I. Programs of Focus: Credentials Table

Appendix I Table. Credential Detail for Focal Programs at Case Study Colleges

School	Program	Degrees/Certificates Offered	Program Description
Estrella Mountain	Power systems technology	No longer offered at Estrella Mountain	
Estrella Mountain	Automated industrial technology (AIT)	• AAS degree • AIT I Certificate • AIT II Certificate • Industrial Technology for Semiconductor Certificate • Robotics Technology Certificate	"Programs give you the hands-on skills you need to design, develop, or repair high-tech equipment and processes."
Mesa	Welding	• AAS degree • Welding Certificate • Welding: Fundamentals Certificate • Welding: Gas Metal/Flux Cored Arc Welding Certificate • Welding: Gas Tungsten Arc Welding (GTAW) Ferrous Certificate • Welding: Gas Tungsten Arc Welding (GTAW) Non-Ferrous Certificate • Welding: Shielded Metal Arc Welding (SMAW) Pipe Certificate • Welding: Shielded Metal Arc Welding (SMAW) Plate Certificate	"You'll learn the ropes of Oxy-Fuel welding (OFW) and cutting (OFC), as well as Shielded Metal Arc welding (SMAW) processes under the guidance of our experienced instructors. You'll gain the skills required to work with modern industrial welding equipment using advanced welding practices."
Mesa	Automated industrial technology (AIT)	• AAS degree • AIT I Certificate • AIT II Certificate • Cable and Wire Harness Assembly Certificate • Industrial Electrical Systems Certificate • Industrial Fluid Systems Certificate • Industrial Mechanical Systems Certificate • Industrial Technology for Semiconductor Certificate • J-STD Soldering Certification • Robotics Technology Certificate	"This program will prepare you to operate, monitor, and maintain a variety of automated electro-mechanical, product assembly, process control, and product distribution systems that use programmable controls and other equipment to manage systems. You will learn how to analyze AC/DC circuits and analog/digital systems and how to apply electronic and fabrication techniques while adhering to safety, health, and environmental rules and regulations."
Pima	Welding	• AAS degree • Welding: Basic Certificate • Welding: Fabrication Certificate	"You will be prepared for successful employment in construction fabrication and industrial manufacturing settings as a welder, cutter, fabricator and welding machine operator. PCC Welding offers courses in blueprint reading, metallurgy, and computer-aided drafting as well as the core electric arc welding processes."

School	Program	Degrees/Certificates Offered	Program Description
Pima	Automated industrial technology (AIT)	• AAS degree • AIT I Certificate • AIT II Certificate	"The program prepares students to run the complex automated assembly lines of the future with courses that build upon one another. You could be job-ready in as little as two weeks with your first certification. Then, continue your education, completing additional certifications and earning your associate degree in two years."
Lorain	Automation engineering	• AAS degree • Bachelor's degree • Robotics Operator Certificate • Maintenance Technician Certificate	"The Automation Engineering program prepares students to work as automation and robotics engineering technologists. You'll learn to work with robots, computer numerical control (CNC) equipment, and programmable logic controllers (PLCs). You'll also gain fundamental knowledge in the principles of mechanical engineering technology, electrical and electronic circuits, quality control, and research and development techniques."
Lorain	Microelectronic manufacturing (MEMS)	• AAS degree • Bachelor's degree • MEMS Certificate (one year) • MEMS Certificate (short-term) • Semiconductor Cleanroom Maintenance Technician Certificate	"Microelectronic Manufacturing, abbreviated at LCCC as MEMS, is a manufacturing process for electronic hardware such as circuit boards, flexible substrates, and motherboards that integrate technology, semiconductors and components at the micro and sub-micro scale as well as microelectromechanical components such as sensors into one functioning system. The field requires training and education in electronics, computer-aided drafting, soldering, use of microscopes for inspection, use of electronic equipment for testing, design software for manufacturing, working within a cleanroom manufacturing environment for semiconductors, quality concepts such as Lean Six Sigma, and builds upon experience gained as the technology industry continues to change and grow with new groundbreaking devices."
Columbus State	Electronic engineering technology	• AAS degree	"The Electronic Engineering Technology AAS degree program provides students with the instruction and hands-on training to support the design, installation, testing, operation, troubleshooting, maintenance, and repair of analog and digital electronics and embedded programmable microcontroller systems."

School	Program	Degrees/Certificates Offered	Program Description
Columbus State	Electro-mechanical engineering technology	• AAS degree • Manufacturing Equipment Technician Certificate • Semiconductor Fundamentals Certificate	"The Electro-Mechanical Technology program is a marriage of Columbus State's Mechanical Engineering Technology and Electronics Engineering Technology programs. The skills Electro-Mechanical Engineering technicians possess are used in virtually every industry—from manufacturing, to environmental control, to food and pharmaceutical production, to power plants. Electro-Mechanical Engineering technicians are immediately able to contribute to the companies that hire them."
Clark State	Manufacturing engineering technology	• AAS degree • Computer Numerical Control Certificate • Manufacturing Certificate • Additive Manufacturing Certificate • Welding Certificate • Computer-Aided Design Certificate • Robotics Certificate • Industrial Maintenance Certificate	"The Manufacturing Engineering Technology program prepares students for a variety of positions within a manufacturing facility."
Clark State	Industrial technology	• AAS degree • Bachelor's degree • Embedded certificates not listed on site	"The program is intended to train for career fields such as machine repair technician, electrical maintenance technician, or industrial maintenance mechanic."
Gateway Technical	Advanced manufacturing technology	• Associate degree • Mechanical Maintenance Technician Certificate • Electromechanical Maintenance Technician Technical Diploma	"Program yourself a successful, high-tech Industry 4.0 career that Wisconn Valley's employers will put in high demand. With an Advanced Manufacturing Technology associate degree from Gateway, you'll work with intelligent automation to improve the efficiency of the manufacturing process. You'll train in mechanics, information technology and electrical equipment, so this program is a smart choice if you enjoy working with technology and excel at problem solving."
Gateway Technical	Welding	• Welding Technical Diploma	"If you're burning to cut through the competition and secure a career in a high-demand field, Gateway's Welding technical diploma is a hot choice. You'll get hands-on training with advanced welding concepts. Brighten your career prospects by gaining the skills and knowledge employers in the construction, engineering, auto and aerospace industries need."
Daytona State	Engineering technology	• AS degree	"The Associate of Science in Engineering Technology degree

School	Program	Degrees/Certificates Offered	Program Description
		• Engineering Support Specialist Certificate • Computer-Aided Design and Drafting Certificate	program is your gateway to a dynamic and rewarding career in the ever-evolving fields of manufacturing and high technology."
Daytona State	Computer engineering technology	• AS degree • Applied Technology Specialist Certificate	"Join our Associate of Science in Computer-Aided Design and Drafting Certificate program and set yourself on the path to success. Gain the skills and expertise needed to excel in planning, designing, and detailing engineering projects."

Appendix II. Activities Checklist

Appendix II Table. Economic Development Activities at Case Study Colleges

HII Activities Checklist	Pima	Mesa	Estrella	Lorain	Clark	Columbus	Daytona	Gateway	Total Count of Schools
Education & training: Program activities									
Hands-on learning	X	X	X	X	X	X	X	X	8
Club/Maker space	X		X	X				X	4
Work-based learning	X	X	X	X	X	X	X	X	8
Learn-and-earn model				X	X	X	X		4
Paid internships/co-ops as program requirements	X	X							2
Apprenticeships	X	X	X		X			X	5
Grants for equipment	X	X	X	X	X	X	X	X	8
Dual enrollment	X	X	X	X	X	X	X	X	8
BA pathway	X	X	X	X	X	X	X	X	8
Associate programs credited toward one or more of the college's Bachelor's program				X	X		X		3
Articulation agreement(s) with other colleges or universities	X	X	X	X		X	X	X	7
Credit for prior learning/Prior learning assessments	X	X		X	X	X	X	X	7
Short-term (less than one year) training/Bootcamp style	X	X	X	X	X			X	6
Noncredit-to-credit pathways	?	?	X	?	?	?	?	?	1 (7)
Updated curriculum aligned with jobs	X	X	X	X	X	X	X	X	8
National credentialing/Industry certification	X	X	X	X	X			X	6
Regionally aligned and developed program/Courses & programs aligned with local workforce needs	X	X	X	X	X	X	X	X	8
Education & training: Employer engagement									
Industry advisory boards	X	X	X	X	X	X	X	X	8
Community job fair/Expo			X	X					2
School/program job fairs and related events, program reverse job fairs, or online matching with employers	X	X	X	X	X	X	X	X	8
Hiring majority of faculty for a program from industry	X	X	X	X					4

Visits with employers on-site		X		X	X			X	4
Business support									
Small business incubator and assistance	X			X			X	X	4
Incumbent worker/customized training	X	X	X	X	X	X	X	X	8
Entrepreneurship training			X	X			X		3
Establishment of facilities for use by local companies	X			X	X		X	X	5
Technology transfer & applied research	X			X	X	X		X	5
Regional engagement									
Conducting economic scans				X			X		1
Participating in local economic planning/policymaking	X	X	X	X	X	X	X	X	8
Leading/coordinating other colleges on industry needs	X	X		X		X			4
Leading regional organizations or convening regional stakeholders	X	X		X		X			4
Participating in state/regional boards	?	?		X	X			X	3
Assisting in attracting employers to the region	X	X	X	X		X	X	X	7

CHECKLIST FOR COMMUNITY COLLEGE ENGAGEMENT IN ECONOMIC DEVELOPMENT:

What follows is a checklist of the activities the eight community colleges in our sample—all national leaders in administering technician education programs—implemented, organized by type of activity and whether all or some colleges implemented the activity.

EDUCATION AND TRAINING

ALL CASE STUDY COLLEGES DO...

	Yes, we do this too!	No, we don't do this currently.
Hands on learning	☐	☐
Work-based learning (*some type)	☐	☐
Grants for equipment	☐	☐
Dual Enrollment	☐	☐
BA pathway (**some type)	☐	☐
Updated curriculum aligned with jobs	☐	☐
Regionally aligned, developed programs /courses, and programs aligned with local workforce needs	☐	☐
Industry advisory boards	☐	☐
School/program job fairs and related events, program reverse job fairs, or online matching with employers	☐	☐

SOME CASE STUDY COLLEGES DO...

Club/maker space	☐	☐
Credit for prior learning/prior learning assessments	☐	☐
Short-term training/bootcamp (<1 yr)	☐	☐
Noncredit-to-credit pathway	☐	☐
National credentialing/ industry certification	☐	☐
Community job fair/ expo	☐	☐
Hire majority of program faculty from industry	☐	☐
Visits with employers on site	☐	☐

BUSINESS SUPPORT

ALL CASE STUDY COLLEGES DO...

Incumbent worker/ customized training	☐	☐

SOME CASE STUDY COLLEGES DO...

Small business incub0ator/ assistance	☐	☐
Entrepreneurship training	☐	☐
Establishment of facilities for use by local companies	☐	☐
Tech transfer or applied research	☐	☐

REGIONAL ENGAGEMENT

ALL CASE STUDY COLLEGES DO

Participate in local economic planning/policymaking	☐	☐

SOME CASE STUDY COLLEGES DO...

Conduct economic scans	☐	☐
Lead/coordinate other colleges on industry needs	☐	☐
Lead regional organizations or convene regional stakeholders	☐	☐

Participate in state/regional boards

Assist in attracting employers to region

NOTE ON WORK-BASED LEARNING TYPES

Work-based learning is a vital component of successful technical education programs. All colleges implemented some form of work-based learning. The specific advantages and disadvantages of the different types of work-based learning is an opportunity for future research.

1 | Learn-and-earn models (4 colleges)

2 | Paid internships/co-ops as program requirements (2 colleges)

3 | Apprenticeships (5 colleges)

Appendix III. Detailed Roles Checklist

Appendix III Table. Interview Participants' Institutional Roles At Case Study Colleges

Pima, Roles	
Senior administrators, total	*4*
Faculty and instructors, total	*1*
Program/Center-related managerial roles, total	*0*
Student advisors, total	*1*
Business advisors, total	*0*
Total roles involved (in study)	*6*
Senior administrators, detail	4
Department head, machine tool technology (year 1). Same person listed with the title machining faculty in year 2	
Dean of applied technology	
Dean of workforce education and continuing education	
Vice chancellor of workforce development and innovation	
Faculty and instructors, detail	1
Instructor, machine tool technology (year 1)/same person in year 2 listed with title machining faculty	
Student advisors, detail	1
AIT program advisor	
*Other [Current and former students working at employer partner firms]	2.
Mesa, Roles	
Senior administrators, total	*1*
Faculty and instructors, total	*4*
Program/Center-related managerial roles, total	*1*
Student advisors, total	*2*
Business advisors, total	*1*
Total roles involved (in study)	*9*
Senior administrators, detail	1
Assoc. Dean for Maricopa Community College Workforce & executive director of the Arizona Advanced Manufacturing Institute	
Faculty and instructors, detail	4
AIT director	
AIT instructor	
WLD director	
Adjunct faculty	
Center-related managerial roles, detail	1
Director, Maricopa IT Institute	
Student advisors, detail	2

Career navigator	
Student navigator	
Business advisors, detail	1
District deputy chief director for workforce and economic development	
Estrella, Roles	
Senior administrators, total	*2*
Faculty and instructors, total	*2*
Program/Center-related managerial roles, total	*0*
Student advisors, total	*2*
Business advisors, total	*0*
Total roles involved (in study)	*6*
Senior administrators, detail	2
Dean (inst-workforce math-science)	
Dean of instruction and occupational education during year 1 and interim vice president of academic affairs during year 2, VP workforce	
Faculty and instructors, detail	2
Manufacturing technology faculty	
Adjunct faculty & SouthWest gas customer service manager	
Student advisors, detail	2
Student services supervisor	
Navigator	
Lorain, Roles	
Senior administrators, total	*6*
Faculty and instructors, total	*2*
Program/Center-related managerial roles, total	*4*
Student advisors, total	*1*
Business advisors, total	*2*
Total roles involved (in study)	*15*
Senior administrators, detail	6
Provost/vice president for academic affairs and university partnership	
Dean, engineering, business, and information technologies	
Dean of accreditation & assessment of student learning	
Vice president for strategic and institutional development	
Director, school, workforce & community partnerships	
Vice president for enrollment management and student services	
Faculty and instructors, detail	2
Assistant professor, program coordinator AET systems specialist and maintenance & repair program coordinator	
Director of MERIT & asst. professor of MEMS/ MEMS instructor	
Program/Center-related managerial roles, detail	4
Manager of training programs, automation & robotics	

Managing director, SMART microsystems (located on Lorain Campus)	
Ohio TechNet (person in this role splits time between working as the director of Ohio TechNet and director of talent and business innovation for LCCC)	
Institutional research, planning and engagement	
Student advisors, detail	1
Manager of career services	
Business advisors, detail	2
Program developer	
Talent and business innovations/Director, talent and business innovation	
Other [student working at an employer partner firm]	1
Clark, Roles	
Senior administrators, total	*6*
Faculty and instructors, total	*4*
Program/Center-related managerial roles, total	*1*
Student advisors, total	*1*
Business advisors, total	*1*
Total roles involved (in study)	*13*
Senior administrators, detail	6
President	
Dean of business and applied technologies	
Assistant dean, School of Business and Applied Technologies	
Vice president of marketing, diversity and community impact	
Vice president of academic affairs	
Director of admissions and career services	
Faculty and instructors, detail	4
Principal technical instructor, business and applied technologies	
Professor, engineering technologies/Professor and coordinator for engineering technologies	
Assistant professor (year 1 title)/ assistant	
Welding instructor and program coordinator	
Program-related managerial roles, detail	1
Project manager, H1B One workforce grant, business & applied technologies	
Student advisors, detail	1
Career services coordinator	
Business advisors, detail	1
Director of workforce and business solutions	
Columbus, Roles	
Senior administrators, total	*2*
Faculty and instructors, total	*2*
Program/Center-related managerial roles, total	*1*
Student advisors, total	*2*

Business advisors, total	*1*
Total roles involved (in study)	*8*
Senior administrators, detail	2
Chair, engineering & transportation technologies	
Director, partnerships & programs	
Faculty and instructors, detail	2
Professor, mechanical and electro-mechanical engineering	
Faculty, engineering technology	
Center-related managerial roles, detail	1
Project manager, MMWS	
Student advisors, detail	2
Academic advisor	
Career counselor	
Business advisors, detail	1
Executive in residence, Office of Talent Strategy. Interviewed as an employee of Honda in year 1 and as an employee of Columbus State in year 2	
Daytona, Roles	
Senior administrators, total	*2*
Faculty and instructors, total	*3*
Program/Center-related managerial roles, total	*0*
Student advisors, total	*2*
Business advisors, total	*1*
Total roles involved (in study)	*8*
Senior administrators, detail	2
Chair for School of Computer Science	
Associate vice president	
Faculty and instructors, detail	3
Professor in FAME program	
Associate professor	
Assistant professor (year1 title)/Drafting design instructor (year 2 title)	
Student advisors, detail	2
Work Experience Coordinator	
Work-based learning advisor/work-based learning advisor and success coach	
Business advisors, detail	1
Director for the Center of Business and Industry	
*Other [Student working at an employer partner firm]	1
Gateway, Roles	
Senior administrators, total	*5*
Faculty and instructors, total	*2*
Program/Center-related managerial roles, total	*0*
Student advisors, total	*1*

Business advisors, total	*0*
Total roles involved (in study)	*8*
Senior administrators, detail	5
President	
VP workforce	
Dean, manufacturing and engineering (year 1)/Dean, School of MEIT (year 2 had different person in this role)	
Dean, School of iMET	
Associate dean for manufacturing engineering and IT/Associate dean for SMEiT	
Faculty and instructors, detail	2
Welding instructor (year 1)/Division chair of welding, HVAC, facilities (same person year 2) and a second person with role of welding instructor in year 2	
Advanced Manufacturing Instructor	
Student advisors, detail	1
Employment specialist	
Other [Student working at an employer partner firm]	1

Appendix IV. Partner Survey Questions and Response

Appendix IV Table. Survey Questions for and Responses from Regional Economic Development Partners of Case Study Colleges

Survey Section	Question	Response Summary (Response Counts Are in Parentheses in Decreasing Order)
Stats_Q1 [Counts / % respondents indicated]	Which colleges has your organization worked with on economic development in your region? Select multiple if appropriate.	Gateway, Lorain (10 counts / 32%, each respectively); Columbus State (8 / 26%); Clark State (6 / 19%); Daytona State, Pima, Estrella Mountain (2 / 6%, each respectively); Mesa (1 / 3%)
Stats_Q2	Which college is your organization most familiar with regarding economic development? Please select one.	Gateway (29%), Lorain (23%); Clark State, Columbus State (13% each); Daytona State, Pima, Estrella Mountain (6% each); Mesa (3%)
Stats_Q3	Which of the following organizational types best describes your organization?*	Chambers (23% of respondents); Other (16%); K–12, public workforce organization (13% each); Community-based organizations (10%); City or county government, industry association, post-secondary education (6% each); Public training organization, state government (3% each)
Stats_Q3	"Other" responses for Q3.	Private statewide economic development organization; economic development organization; regional economic development non-profit; private economic development corporation; public-private partnership
Stats_Q4	How long has your organization partnered with the college you are most familiar with regarding economic development?	3+ years (97%); 1–2 years (3%)
Stats_Q5	How closely has your organization worked with that college in the past year?	Very closely (52%); Closely (42%); Not very closely, Somewhat closely (3% each)
Stats_Q6	What best describes the primary role you play in the relationship to that college?	Other (65%); Beneficiary of talent/training/services (13%); Provide training or instruction, Partner to attract funding, Advisory board member (6% each); Program participant (3%)
Stats_Q6	"Other" responses for Q6.	Promoter; superintendent of K–12 district served by college; advising partner; partner; user of college's talent services (as vendor) and strategic partner in economic development efforts; partner to diversify college programs; community partner; collaborator on development of curriculum for specific sectors; partner in service to community; provider of assistance to students

Survey Section	Question	Response Summary (Response Counts Are in Parentheses in Decreasing Order)
		in programs; educational partner; connector between college's talent/training/services and business community; collaborator on workforce development initiatives; strategic partner; collaborator on grant-funded projects and strategy; partner for referrals, strategy, coordination of services, and attracting funding; partner on employer training opportunities; connector for businesses seeking workforce support; collaborator on veterans employment for program graduates
Stats_Q7 [Counts / % respondents indicated]	What are the various other roles you play in your relationship to that college? Please select all that apply.	Exchange information with college (23 counts, 74% respondents selected this role); receive services from college (18, 58%); work with college to recruit and retain talent in the region (17, 55%); coordinate regional planning with college (17, 55%); work with college to recruit and retain firms in the region (16, 52%); sponsor an event with college (15, 48%); provide services to college (13, 42%); apply for funding with college, advising the college (11, 35%, respectively); set state or regional priorities with college (6, 19%); serve on board with college representatives, coordinate state policy action with college (5, 16%); other (4, 13%); none (1, 3%)
Stats_Q7	"Other" responses for Q7.	Workforce training (college is on their eligible training provider list); coordinate on project implementation; share best practices, e.g., re. earn-and-learn models; regional strategy for recruiting, training, supporting a diverse and inclusive workforce; inform business of resources available from college
Stats_Q8	To the best of your ability, estimate the number of students, workers, and companies that are engaged regarding your collaboration with your college partner:	(See below)
Stats_Q8 [Counts]	Number of students engaged?	100+ (9 counts); I don't know (6 counts); 21–50 (5 counts); 51–100 (3 counts);1–10, 11–20 (2 counts each)
Stats_Q8 [Counts]	Number of workers engaged?	100+ (8 counts); I don't know (8 counts); 1–10 (6 counts); 11–20, 21–50 (2 counts, each); 0 (1 count)
Stats_Q8 [Counts]	Number of companies engaged?	1–10 (11 counts); I don't know, 21–50, 100+ (4 counts, each); 11–20, 51–100 (2 counts, each)
Likert, Activities_Q9	Based on your experience with the activities of your college partner,	(See below; in order of decreasing agreement)

Survey Section	Question	Response Summary (Response Counts Are in Parentheses in Decreasing Order)
	state whether you agree or disagree with the following statements. My college partner…	
Likert, Activities_Q9	*Provides high-quality training and education to enhance technical skills for manufacturing in the region.*	Agree (30 counts); Neither agree nor disagree (1); Disagree (0)
Likert, Activities_Q9	*Makes a unique contribution to and adds value to regional economic development efforts.*	Agree (28 counts); Neither agree nor disagree (3); Disagree (0)
Likert, Activities_Q9	*Provides high-quality services to manufacturing businesses to sustain and grow operations in the region.*	Agree (28 counts); Neither agree nor disagree (3); Disagree (0)
Likert, Activities_Q9	*Enhances the competitiveness of the region.*	Agree (26 counts); Neither agree nor disagree (5); Disagree (0)
Likert, Activities_Q9	*Has one or multiple points of contact that are easily identified, responsive, and contribute to regional economic development initiatives.*	Agree (23 counts); Neither agree nor disagree (6); Disagree (2)
Likert, Activities_Q9	*Is the primary provider of technician education and training.*	Agree (22 counts); Neither agree nor disagree (7); Disagree (2)
Likert, Activities_Q9	*Leads regional planning and development efforts that enhance the competitiveness of the region.*	Agree (20 counts); Neither agree nor disagree (10); Disagree (1)
Likert, Activities_Q9	*Is the primary provider of business services.*	Agree (7 counts); Neither agree nor disagree (18); Disagree (6)
Likert, Results_Q10	Based on your experience with the results of your college partner, state whether you agree or disagree with the following statements. My college partner…	(See below)
Likert, Results_Q10	*Attracts talent into the manufacturing field through technician training (recruits new labor market entrants, aids in career transitions, or upskills people on the job).*	Agree (27 counts); Neither agree nor disagree (4); Disagree (0)

Survey Section	Question	Response Summary (Response Counts Are in Parentheses in Decreasing Order)
Likert, Results_Q10	*Helps manufacturers to thrive by providing various support services in addition to training and education.*	Agree (25 counts); Neither agree nor disagree (5); Disagree (1)
Likert, Results_Q10	*Broadens the technician talent pool by recruiting women and people of color or by assisting low-wage earners, veterans, and formerly incarcerated to access well-paying jobs in manufacturing.*	Agree (24 counts); Neither agree nor disagree (5); Disagree (2)
Likert, Results_Q10	*Inspires young people to pursue technician training and well-paying local area jobs in manufacturing.*	Agree (23 counts); Neither agree nor disagree (7); Disagree (1)
Likert, Results_Q10	*Influences behavioral changes by schools and workforce support providers, such as directing more students and job seekers to seek well-paying job opportunities with local manufacturers.*	Agree (23 counts); Neither agree nor disagree (5); Disagree (2)
Likert, Results_Q10	*Convinces manufacturers to invest in technician training (sponsorship of programs and investment in training on the job) by demonstrating results and Return on Investment.*	Agree (22 counts); Neither agree nor disagree (8); Disagree (1)
Likert, Results_Q10	*Influences behavioral changes by manufacturers, such as redesign of educating and training requirements, to better utilize local talent.*	Agree (20 counts); Neither agree nor disagree (9); Disagree (2)
Likert, Region_Q11	Based on your experience with the region as a whole, state whether you agree or disagree with the following statements. **In the region as a whole...**	(See below)
Likert, Region_Q11	*Manufacturers who invest in technician education and training are supported.*	Agree (29 counts); Neither agree nor disagree (2); Disagree (0)
Likert, Region_Q11	*Innovative and productive manufacturing firms are supported.*	Agree (26 counts); Neither agree nor disagree (4); Disagree (1)
Likert, Region_Q11	*There is innovation, production, and inclusivity of women, people of color,*	Agree (23 counts); Neither agree nor disagree (6); Disagree (2)

Survey Section	Question	Response Summary (Response Counts Are in Parentheses in Decreasing Order)
	and groups with barriers to employment.	
Likert, Region_Q11	*Manufacturers achieve a high Return on Investment from training investments.*	Agree (22 counts); Neither agree nor disagree (9); Disagree (0)
Likert, Region_Q11	*Manufacturers retain talent by paying competitive wages, providing good jobs and/or promising career pathways.*	Agree (21 counts); Neither agree nor disagree (8); Disagree (2)
Likert, Region_Q11	*Coordination results in transformative projects that ensure local businesses have the technology and talent necessary to sustain and grow their business.*	Agree (20 counts); Neither agree nor disagree (10); Disagree (1)
Likert, Region_Q11	*Employers champion technician education and training.*	Agree (19 counts); Neither agree nor disagree (10); Disagree (2)
Likert, Region_Q11	*Federal funding is secured for important regional economic development activities.*	Agree (18 counts); Neither agree nor disagree (11); Disagree (2)
Likert, Region_Q11	*Stakeholders navigate state policy and funding opportunities and overcome challenges/limitations.*	Agree (18 counts); Neither agree nor disagree (11); Disagree (2)
Likert, Region_Q11	*Employers lead conversations about technical education and training needed now and in the future.*	Agree (18 counts); Neither agree nor disagree (11); Disagree (2)
Likert, Region_Q11	*Businesses co-invest in technician education and training (e.g., setting up jointly funded programs).*	Agree (16 counts); Neither agree nor disagree (9); Disagree (6)
Likert, Region_Q11	*Young people are inspired to pursue technician education and jobs in manufacturing.*	Agree (12 counts); Neither agree nor disagree (10); Disagree (9)
Qual_Q12	What is the most important or impactful activity within the last year related to technician training? Please type answer.	Expansion/promotion of youth apprenticeship opportunities (2 counts); introduction of 5G Broadband statewide initiative; FAME program; bootcamps; work-based learning; semiconductor curriculum development, semiconductor technician training program (2 counts); creating skill-based apprenticeship programs that fit multiple companies; employers and county presenting to students in high school to spark interest in manufacturing career path (manufacturing day);

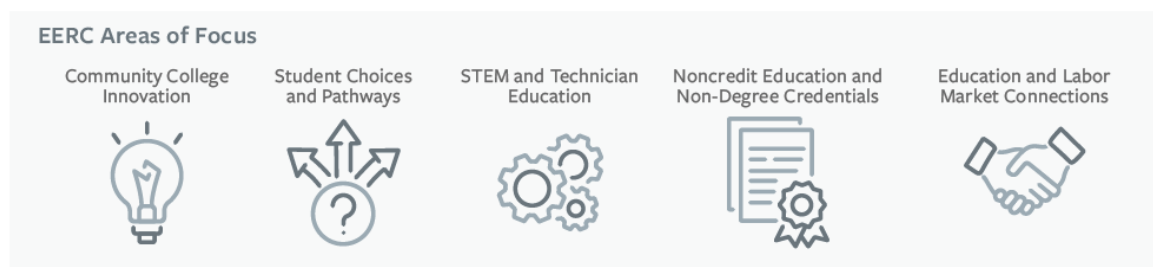| Survey Section	Question	Response Summary (Response Counts Are in Parentheses in Decreasing Order)
		employer engagement in roundtables or consortiums or provide feedback on training curriculum; taking students to the college to see innovative programs in manufacturing, 2 and 4 year degrees; teacher immersion program (teachers go to companies to understand what they do to help students identify best-fit careers); recruitment; recognition by state leaders that more resources and coordination are needed for tech. education and training for effective metrics and aligned strategies across investments; emerging partnership among local workforce development nonprofits, the college and the workforce development board at regional level; several colleges developing a curriculum together for big employer re. training technicians; opening a new advanced manufacturing training facility, an asset with potential to get people interested in manufacturing , demonstrate regional commitment to supporting manufacturing; local city economic development entities signed agreements with the college and regional business partnership org. for adult career and technical education that offer adult age scholarships to community members; big national tech company planned partnership with college

Appendix V. Partner Interview Questions

Appendix V Table. Interview Questions for Regional Economic Development Partners of Case Study Colleges

Q	Interview Questions for Partner Interviews
Q1	What is your role at the organization? Can you explain to me what you do?
Q2	How do you define economic development? What kinds of activities does it entail?
Q3	How does your organization contribute to economic development?
Q4	What organizations in your region does your organization partner with for economic development? for workforce dev?
Q5	What role do you think [community college name] plays in economic development?
Q6	What is the relationship of your organization with [insert name of community college]? In what ways/on what activities do you interact?
Q7	How does your organization interact with (community college)? Who at your organization interacts with the college? In what ways?
Q8	Who do you work with at the college? What department is that person in? Are there specific departments that you work with? Regular meeting? Serve on same committees, informal, but regular communication, advisory board participation, partnering on education/workforce/employer issues projects, other?
Q9	Do you serve on advisory boards for the college? How do you function in an advisory capacity? What do those meetings typically look like?
Q10	Who leads most of these partner projects, activities your organization, the college, others?
Q11	How do you work with local industry/employers?
Q12	How would you describe the relationship between [community college name] and local industry?
Q13	Do you ever get feedback from industry on graduates from [insert name of community college]'s programs?
Q14	What are the strengths of [community college name] in regional economic development? Weaknesses?
Q15	What are some opportunities for growth for [community college name] in regional economic development?

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