
Responding to diversity: workforce intermediation in a transitioning regional economy

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Abstract. In this paper I examine workforce intermediation as a tool for regional economic transition. While most studies of workforce intermediation in the United States focus on targeted programs that work with less-advantaged socioeconomic groups, I examine strategies adopted by state-funded community colleges that have a more encompassing or universalistic mandate. Through a case study of North Carolina's BioWork initiative I examine college-level strategies for assisting two distinct groups of job seekers in biopharmaceuticals—those with less education and traditional manufacturing backgrounds and those with college degrees and considerable technology experience. In documenting these strategies I suggest lessons for other regions seeking to influence local labor-market conditions and, in turn, balance the employment needs of diverse socioeconomic groups.

Introduction

Social policy advocates have long debated the merits of targeted versus universal program supports, particularly for addressing the needs of disadvantaged socioeconomic groups (Greenstein, 1991; Skocpol, 1991). While targeted programs support disadvantaged participants through focused resources and dedicated staff attention, they also risk program marginalization as a result of their narrow focus. Universal programs instead benefit from greater visibility and public awareness, yet can suffer from 'creaming strategies' that privilege better prepared and more qualified user groups and thus potentially undermine program equity goals. This tension is especially prevalent in workforce development in the United States (Barrow, 1993; Glasmeier, 2000; Osterman and Batt, 1993). Open enrollment or universal training programs are effective at garnering broad-based political and policy support and encourage considerable employer 'buy in' thus enhancing job placement opportunities. Still, they are often open to criticism for failing to adequately address the needs of less-privileged job seekers.

What are the challenges for workforce development agencies in trying to balance the needs of diverse program participants? Can workforce development systems be designed to influence local labor market processes and thus balance diverse participant needs? To what extent are they able to harness the benefits of universal coverage to keep open viable employment opportunities for more disadvantaged participants?

I examine these questions through a study of North Carolina's state-funded community college system and, specifically, its BioWork program. BioWork was created by the North Carolina Biotechnology Center and Community College System in the late 1990s primarily to help workers to transition from declining traditional manufacturing industries—especially textiles, furniture, and tobacco manufacturing—to the state's fast-growing biopharmaceuticals industry. Requiring basic math skills (9th grade level) and a high school degree or equivalent, this semester-long program provides students with the equivalent of one year of industry experience and qualifies them for entry-level positions at North Carolina's pharmaceutical drug and vaccine manufacturing facilities. Shortly after its launch in 2001, BioWork also attracted the attention of job seekers of a different type—college degree holders, many with considerable technology

experience, who were displaced from the state's microelectronics, telecommunications, and information technology industries. For this second, more educated group of participants, BioWork offers transitional training that allows them to adapt their existing industry and academic knowledge to the emerging field of life sciences. This group accounts for approximately one third of recent BioWork participants.

The influx of higher educated, technology-oriented job seekers to BioWork has increased program enrollment and enhanced the program's reputation. This strengthens the ability of North Carolinian economic developers to use BioWork as a promotional tool for recruiting biopharmaceutical manufacturers from outside the state (Lowe, 2007). Still, this diversity creates a program challenge. Recruited biopharmaceutical firms—many with headquarters in Massachusetts and California—often arrive with existing hiring preferences, favoring higher educated and technology-experienced workers. This potentially undermines employment opportunities for BioWork's less-educated and less 'tech'-experienced participants. In response, a growing number of BioWork colleges have experimented with novel workforce intermediation strategies that allow them to move beyond their traditional roles as training providers to also shape hiring decisions so that less-educated job seekers can secure quality positions in biopharmaceuticals and related industries. Key to this effort are concurrent strategies for increasing employer recognition of the skill sets of less-educated job seekers, as well as their contribution to workforce stabilization.

I document three specific intermediation strategies: first, the development of employer partnerships which enable BioWork colleges to advocate for local hiring goals; second, the marketing of BioWork to industries outside of biopharmaceuticals, but in related areas, that utilize similar production processes and quality standards; third, experimentation with temporary job search strategies that allows BioWork colleges to help higher educated job seekers secure higher ranking positions at life science firms and thus reduce unnecessary competition with less-educated job seekers. I conclude by discussing lessons for other US regions that are seeking to expand the role of their community college system in an effort to make their own transitional training supports more socially inclusive.

Workforce intermediation in a diverse regional economy

Labor economists, drawing heavily on core tenets of human capital theory, have long insisted that the central US workforce development challenge is resolving the 'skills mismatch'—that is, the inability of job seekers to keep up with the ever-changing employer skills requirements (Berman et al, 1994; Katz and Autor, 1999). This is often the explanation given for increased US income inequality, the logic being that the rising supply of less-skilled workers puts downward pressure on wages and lowers job retention rates for all but the highly educated.

Challenges to this logic have emerged in recent years. Rather than focusing narrowly on the failure of US workers to keep up with changing skill needs, greater attention is now paid to shifting labor market institutions and, specifically, the loss or weakening of traditional channels for demonstrating, developing, and defending worker skill (Fligstein and Shin, 2004; Levy and Temin, 2007; Osterman, 1999). In earlier decades the majority of US workers gained skills through on-the-job training and industry-sanctioned apprenticeship programs that were workplace specific (Doeringer and Piore, 1971; Osterman, 1999). As a result, employers and supervisors were able to easily track the skill development process of their existing workforce. Equally important, workers were rewarded for on-the-job skill development through well-structured internal career ladders. These internal advancement opportunities both encouraged and were reinforced by long job tenures which were characteristic of the post-World-War-II US

labor market (Osterman, 1999). Industrial unions provided additional institutional support for internal labor market development. Unions also represented workers with low levels of formal schooling and ensured that skills learned on the job and through work experience were valued and rewarded, and thus contributed to social mobility.

By contrast, today's workers have fewer internal opportunities to develop and defend their skills as a result of more frequent job changes and shortened job tenure. In contrast to conventional human capital theories that focus narrowly on how differences in skill level affect labor market mobility, emergent labor-market theories emphasize the 'institutional gap' in the current US labor market and its implications for job quality and career development. In this context the decline of unions is particularly problematic given their traditional institutional role in defending internal career ladders and pathways to skills-based advancement. The weakening of labor unions, along with the decline of internal labor markets, therefore adds to rising income inequality in the United States by making it more difficult for less-educated workers to reveal and defend their skills as they work through the labor market (Howell, 1994; Osterman, 1999).

In response to this challenge, new skill formation supports have emerged in recent years to try and fill this institutional gap. Included in this group are numerous private and nonprofit 'job-centered' development programs with facilities in economically distressed regions of the United States, including low-income inner cities and declining rural and rust-belt economies (Chapple and Zook, 2002; Fitzgerald, 2006; Giloth, 2004). Unions, for their part, have also expanded their role in supporting external career ladder development, often through sequenced training programs that help both incumbent workers and prospective job seekers advance their careers despite frequent job changes (Conway and Loker, 1999; Rothman, 2003).

By providing training assistance, these workforce development programs have helped less-educated workers secure credentials for accessing new jobs and advancing their careers. Still, they do more than just increase the supply of skilled workers. Many of these programs structure their training support in ways that allow them to also shape local hiring practices, thereby influencing adjustments in both labor-market *supply* and labor-market *demand*. They do so by adopting a 'dual-customer' approach (Fitzgerald, 2004; Giloth, 2004). This means they work closely with job seekers in order to improve their job prospects through training and job placement assistance. Still, they also work closely with groups of employers to identify training needs and to solicit input on curriculum design (Lautsch and Osterman, 1998). By embedding multiple employers within these programs, administrators are often in a position to negotiate on behalf of disadvantaged job seekers. Part of this strategy involves identifying potential credentialing mismatches and, more specifically, industry hiring practices that potentially "overestimate the skills needed for many entry-level jobs, thus eliminating many qualified applicants" (Fitzgerald, 2004, page 4). Additionally, these employer networks allow administrators to identify potential sticking points, such as regional labor shortages or high rates of worker turnover, around which established industry hiring criteria can be renegotiated (Fitzgerald, 2006; Osterman, 2005).

Referred to as *workforce intermediation*, this dual-customer approach has been well documented for agencies and organizations that target disadvantaged US populations (Fitzgerald, 2004; Lautsch and Osterman, 1998; Lynch, 2005). Less studied, however, are the intermediation strategies of general-use programs which offer open enrolment training courses and job placement support to a variety of individuals and participants. This is especially true for US community colleges, which represent a new breed of workforce intermediaries and stand apart from community-based nonprofits in their mandate to provide access to and support diverse groups of job seekers (Giloth, 2004; Osterman, 2007).

Initially started as feeder programs for four-year universities, many state community college systems responded to the national economic downturn of the 1970s and 1980s by expanding their vocational training programs and incumbent worker supports (Brint and Karabel, 1989). For the most part these college systems function as vocational training providers, prioritizing applied classroom training and instruction. In recent years a small but growing number of US community colleges have also adopted workforce intermediation strategies in order to actively broker relationships between job seekers and regional employers (Gilothe, 2004; Osterman, 2007; Poppe et al., 2004).

North Carolina's community college system is a pioneer in this area, experimenting with workforce intermediation strategies in biopharmaceutical manufacturing. These strategies are designed to enhance the employment prospects of job seekers from a variety of educational and industrial backgrounds. This is important given the state's diverse industrial economy and especially the wide range of industries affected by recent plant closures and layoffs. Traditional manufacturing industries have experienced significant establishment and employment declines in the state, with the textiles and apparel manufacturing industry eliminating over 200 000 jobs and 870 establishments since 1996.⁽¹⁾ Between 1996 and 2006 the state's furniture-making industry also shed 25 000 jobs, an employment decline of roughly 30% since 1996. Still, traditional industries are not the only ones affected by economic restructuring. Technology-oriented manufacturing industries—namely, information and communications technologies—have also experienced their share of job losses. Since 2001 employment in computers, peripherals, and communications equipment manufacturing and semiconductor and optical media manufacturing has declined by over 37% resulting in a loss of around 35 000 jobs in North Carolina. Both traditional and technology-based manufacturing industries have continued to suffer during the current economic recession. Within this context, workforce intermediation has emerged as a powerful tool for helping distinct groups of job seekers to transition to new employment opportunities.

Research design and methodology

An analysis of workforce intermediation lends itself to a mixed-method research design. This is due to the fact that intermediation strategies involve three distinct sets of actors—the job seeker, the prospective employer, and the organization that seeks to mediate this relationship with the goal of influencing employment opportunities.

To capture the diverse experience of job seekers, my research team conducted two surveys at seven community colleges in North Carolina. These surveys were conducted with students at seven of the twelve colleges offering BioWork—we included only colleges with more than ten students enrolled in the program. Our first survey was completed by 255 (83%) of the 309 students enrolled in BioWork at these colleges in the 2006 spring semester. The slight difference between the enrollment population and our smaller survey population size reflects student absences at the time the survey was administered or refusal to complete the in-class survey. Between mid-October 2006 and February 2007 we conducted a second telephone survey with BioWork students from the same 2006 spring cohort. We attempted contact with all 203 students that indicated interest in participating in our telephone survey. Eliminating students with incomplete contact information reduced our eligible population to 164. During the course of four months we were able to conduct surveys with 125 of these students, providing us

⁽¹⁾ Employment statistics reported in this section were compiled by the North Carolina Employment Security Commission and were accessed through the Duke University North Carolina in a global economy website: http://www.soc.duke.edu/NC_GlobalEconomy/index.shtml

with a sample size of 76% (based on an eligibility of 164) or roughly 50% of the students that completed our first survey. Every eligible student was contacted at least three times by telephone and once by e-mail. We ruled out response bias in our second survey by performing χ^2 distribution tests on individual variables. The tests indicate that there is no evidence that respondents differed across our survey populations.

Our first survey provided detailed information on the work and educational histories of program participants and their eventual career goals and aspirations. The follow-up telephone survey captured changes in employment status before and after program participation.

To learn more about employer skill needs and hiring practices, we conducted in-depth interviews with executives from ten of the state's biopharmaceutical manufacturing firms. We included both large and medium-sized manufacturing firms, as well as a mix of 'home-grown' and branch plant establishments. Interview questions focused on the company background, location decisions, workforce characteristics, and training needs, as well as their relationship with community colleges and state and local economic development agencies. Information gathered through company interviews was supplemented by human resource surveys conducted by the North Carolina Biotechnology Center in 1995 and 2002 with the majority of biopharmaceutical manufacturers in the state. These surveys document dominant hiring practices of biopharmaceutical employers and, in combination with in-depth employer interviews, help to capture industry hiring preferences.

Finally, in order to examine the role of North Carolina's community colleges in mediating the relationship between job seeker and employer, we conducted in-depth interviews with BioWork administrators from our seven surveyed community colleges. Interview questions focused on the college's history and experience with BioWork training, the type of support they offer BioWork trainees with job placement, and the nature of their relationship with regional biopharmaceutical employers. By including this information we were able to understand the unique institutional and labor market challenges that individual colleges face and the specific types of workforce intermediation strategies they develop to address these localized challenges. In addition to collecting information at the college level, in-depth interviews were conducted with training and economic development specialists from the North Carolina Biotechnology Center, Community College system, and Department of Commerce. As illustrated later, these organizations help to strengthen and support the intermediation strategies of individual colleges through their ongoing work with biopharmaceutical employers throughout the state.

Biopharmaceuticals in North Carolina

North Carolina's biopharmaceutical manufacturing industry is made up of two types of manufacturing establishment: (i) biomanufacturing and pharmaceutical manufacturing facilities that produce chemical-based and biological-based drug therapies and (ii) contract manufacturing facilities that offer specialized manufacturing services to local and nonlocal biopharmaceutical establishments. Combined, the state's forty biopharmaceutical manufacturing facilities employ approximately 17 000 workers, averaging annual job growth of 10% since 1990 (North Carolina Biotechnology Center, 2005). Despite the current economic recession, job growth is projected to continue in this industry, due in part to 600 additional jobs that will be created at new facilities set to open in 2010/11.

Table 1. North Carolina's biopharmaceutical-related curriculum, continuing education and Capstone programs 2001–06 (source: North Carolina Community College System Data Warehouse).

	Student enrollment ^a				
	2001–02	2002–03	2003–04	2004–05	2005–06
<i>Curriculum programs</i>					
Biotechnology	60	144	297	492	472
Bioprocess technology	61	56	73	43	97
Industrial pharmaceutical technology	73	92	96	94	80
Chemical process technology	23	7	6	8	7
Chemical technology	30	29	29	26	26
Laboratory technology	1	3	10	19	35
Nanotechnology	0	0	0	3	6
Clinical trials research associate	41	48	70	75	75
Biomedical equipment technology	81	132	141	114	68
Annual totals	370	511	722	874	866
<i>Continuing education program</i>					
	2001	2002	2003	2004	2005
BioWork: process technician training	374	274	761	559	903

^aCurriculum 'reporting year' begins with fall and ends with spring; continuing education program 'reporting year' covers spring, summer, and fall.

Three types of educational and training programs exist to support job creation in North Carolina's biopharmaceutical manufacturing industry. In addition to specialty undergraduate and graduate degree programs at the state's four-year universities, community colleges throughout the state offer both curriculum (two-year associate degrees) and continuing education programs (see table 1). As with curriculum programs, nondegree continuing education programs in biopharmaceuticals have experienced considerable growth in annual enrollment rates. In contrast to associate degree programs that train students for more advanced positions in quality control, machine maintenance, and research and development, continuing education courses are designed to offer basic industry training for entry-level manufacturing jobs. The most notable of these programs is BioWork, a semester-long certificate course that provides students with process technician skills for both biomanufacturing and chemical-based pharmaceutical manufacturing. BioWork is funded primarily by the state government and through federal workforce development assistance programs. While some students are required to pay a small fee for enrollment (US \$65 at the time of our survey), the program was intentionally designed to be state subsidized in order to attract low-income residents. Over 900 students enrolled in BioWork in 2005, an increase of 241% since its first open enrollment offering in 2001. In addition, incumbent workers complete BioWork modules during annual facility maintenance shut-down training sessions that last one to two weeks. BioWork's nine interrelated training modules focus on a range of topics from plant safety and quality control to process sterilization and cell growth. Several BioWork modules and exercises emphasize 'soft-skill' development, including workplace communication and team work. Today, thirteen of North Carolina's fifty-eight community colleges offer versions of this course to the general public, as well as to existing and newly recruited biomanufacturing firms in the form of customized new hire and incumbent worker training support.

BioWork's diverse participants

At 39 years of age, the average student enrolled in North Carolina's continuing education courses is significantly older than his or her counterpart in two-year curriculum or degree programs (28 years).⁽²⁾ On average, North Carolina's continuing education courses attract a slightly higher percentage of men (52%) than women (48%). In 2006 63% of continuing education students self-identified as white, non-Hispanic, while 24% were African-American—this is slightly higher than the state's overall African-American population (21%).

The demographic breakdown for BioWork, also part of the continuing education system in North Carolina, differs considerably. While our 2006 survey indicates a similar average age (38 years) for BioWork participants, 64% of those enrolled in BioWork were female and 53% self-identified as African-American. Some 32% were unemployed or out of the labor market at the time of our survey—the state's unemployment at the time of our survey was around 4.5%. Only 14% of BioWork participants in 2006 had earned a bachelor's degree or higher, compared with 23% across North Carolina. Some 40% of BioWork participants listed some kind of manufacturing job as their longest held, with over one third listing important, yet declining manufacturing industries in the state, including textiles, auto-parts manufacturing, and microelectronics. Additionally, close to 60% of BioWork students listed their longest job held to be in the service sector, with a majority of these in low-paying jobs in retail sales, food service or hospitality, and health care support.

As this suggests, BioWork has successfully attracted participants with low levels of education, with work experience in declining or threatened manufacturing industries, as well as those employed in low-paying service industries. In this regard, BioWork functions as a transitional training course for displaced and disadvantaged job seekers in the state. Still, these program averages obscure important intercollege and intracollege differences. Rather than report college data individually, I have chosen to categorize colleges as rural, urban, or exurban and to compare across these categories. This allows us to see clear differences in participant profiles that reflect variations in industrial geography and local market conditions across the state. Urban and rural college distinctions are based on a classification system developed by the North Carolina Rural Economic Development Center that draws on county population density measures from the 1990 Census of Population—rural counties contain fewer than 200 persons per square mile. Exurban colleges, while located in rural counties, have been reclassified on the basis of two additional characteristics: first, the counties in which they are located or serve border an urban county; second, on the basis of the results of the 2006 BioWork student survey, a majority of students at these colleges have chosen to target their job search in these neighboring urban counties. Two colleges in our survey are classified as urban, two as rural, and three as exurban.

As table 2 illustrates, BioWork students from exurban (17%) and rural-based (24%) colleges are less likely to have earned a college degree (two-year associate or four-year bachelor's degree) compared with their urban-based counterparts (40%). This difference is also notable when we consider students with four-year university degrees. This group represents only 11% of exurban and 16% of rural students, in contrast to 32% of students at urban-based schools. Cross-county differences are also visible when we consider previous industry and work experiences. Students from rural counties are more likely to have traditional manufacturing experience compared with those in urban and exurban areas. This is evidenced by the fact that close to 15% of rural-based students reported both their longest and most recent job held in textile manufacturing.

⁽²⁾This information is provided by the North Carolina Community College System for 2006–07.

Table 2. Regional comparison of BioWork students, spring 2006.

	Urban colleges	Exurban colleges	Rural colleges
Share of female students (%)	56	69	60
Share of non-Hispanic white students (%)	34	41	43
Share of African-American students (%)	56	50	53
Share of students with a college degree or higher (%)	41	17	24
Share of students with a four-year college degree or higher (%)	32	11	16
Share of students with manufacturing experience (%)	40	54	53
Rank order of most commonly reported manufacturing industry experience	Microelectronics; chemicals; auto parts/automotive	Auto parts/automotive; textiles; microelectronics	Textiles; chemicals; auto parts/automotive

By contrast, urban students have very limited employment experience in traditional manufacturing industries. Instead, many have lengthy work histories in technology-related fields, with 16% reporting their longest job held in microelectronics manufacturing and 7% in information technology. In contrast to rural and exurban service sector workers, those with work histories in urban services—of which finance, insurance, and health care are most common—also tend to report tech-related job titles. These differences clearly indicate increased program popularity among nontraditional target groups—namely, higher educated, former technology industry workers in urban areas of the state.

Why should a more diversified participant group matter from a workforce development perspective? For starters, exurban students tend to search for jobs in urban labor markets and therefore potentially compete with this higher educated and tech-experienced urban cohort. Students at rural colleges also indicate interest in securing work at urban-based companies, though to a lesser degree. As evidence for this, exurban and some rural students, when asked where they planned to focus their job search, ranked urban Wake County—home to Raleigh, Cary, and Morrisville—first, or as a close second to their home counties. This seems logical, given the high concentration of biopharmaceutical manufacturing plants in urban counties and especially in the vicinity of the Research Triangle Park, which straddles urban Wake and Durham counties. Clearly this implies greater likelihood for urban-based job openings (figure 1).

Exurban and rural students, in searching for jobs in urban areas, are initially at a relative disadvantage compared with their urban counterparts given certain hiring perceptions and preferences of biopharmaceutical employers. Executives from many urban-based biopharmaceutical facilities have indicated that, when given the choice, they would prefer to hire workers from technology-intensive industries, like microelectronics and telecommunications. When explaining this preference, they often point to complementary skill sets and overlapping work experiences—biopharmaceutical manufacturing, as with that in microelectronics and telecommunications, takes place within a highly sterile, ‘clean room’ environment. Workers in both contexts must adhere to strict industry standards under current Good Manufacturing Practice (cGMP). Executives also mention higher levels of education among displaced microelectronics and telecommunications workers, compared with those in North Carolina’s textile and tobacco industries, which they claim provides a good foundation for firm-specific training.

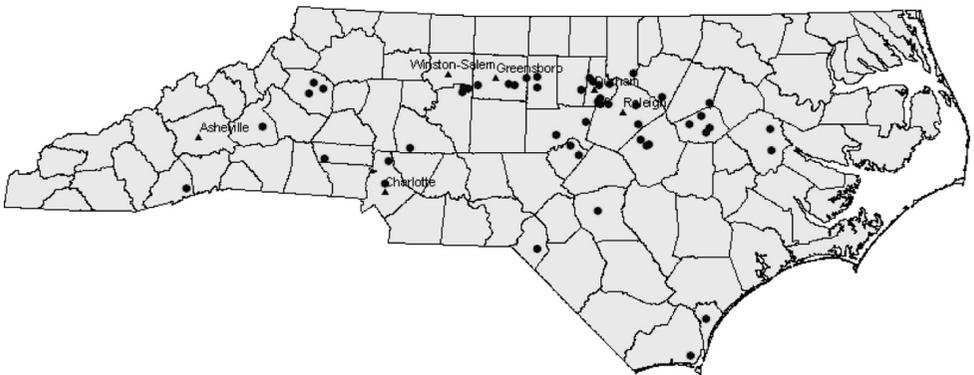


Figure 1. Bioprocessing and pharmaceutical manufacturers in North Carolina (source: North Carolina Biotechnology Center, 2005).

To some extent this preference is visible in our student surveys. Of the eighty-four BioWork participants who applied for biopharmaceutical jobs within eight months of completing BioWork, 54% with previous microelectronics employment experience received a job offer in biopharmaceutical manufacturing. In contrast, only 33% of those with a traditional manufacturing industry background and with no other industrial work experience received similar offers. Those with traditional manufacturing backgrounds, but some additional nontraditional industrial work experience, though not in microelectronics, performed better—41% from this group received biopharmaceutical job offers. Still, as a group, those with prior microelectronics work experience performed better on average during the job search compared with those with no technology industry work experience. Additionally, higher educated job seekers performed considerably better, with 44% of applicants with associated degrees securing biopharmaceutical job offers, compared with only 28% of applicants with a high school degree plus basic vocational training who received job offers in biopharmaceuticals. Only 11% of applicants with no college degree and with no pre-BioWork college-level math or science coursework received an offer.

Given the urban concentration of many of the state's newest biopharmaceutical manufacturing plants and given these industry hiring preferences, increased BioWork participation by higher educated technology workers potentially crowds out the program's intended target group. As a result, one might expect community colleges in the state to push for greater educational resources and support in order to give students with less education and limited technology experience a more equal footing in high-growth, urban labor markets. While colleges certainly advocate for expanded educational opportunities, some have also adopted more direct job creation strategies that attempt to influence and shape local hiring practices and preferences.

At the time of our survey five BioWork colleges functioned as workforce intermediaries. At a basic level colleges categorized as intermediaries share the following three characteristics. First, they develop close working relationships with biopharmaceutical and related employers in their service area. These relationships are typically formalized through regular meetings between company and college staff. Second, intermediary colleges provide job placement assistance that is specific to the biopharmaceutical sector and related production industries. In other words, they do not simply rely on general purpose placement support through a contract with an outside agency, such as a federally funded one-stop center. While students have access to general placement support, intermediaries provide an additional layer of assistance that is industry specific. Finally, intermediaries develop mechanisms for connecting BioWork

students to staff and managers at local biopharmaceutical firms. They often use facility tours or speaker series as a means to expand job networking opportunities for their students. Of the five intermediary colleges we studied, two are urban based, two are exurban, and one is rural based.⁽³⁾ Next, I examine how these workforce intermediary strategies are being implemented and institutionally supported in order to expand employment opportunities in biopharmaceuticals and related industries.

Referral and networking support

The most direct method available to intermediary colleges for shaping local labor market conditions and hiring decisions is reciprocal arrangements that link customized training supports to employee referral arrangements. These arrangements can be broadly classified as ‘first source’ hiring and referral agreements. In their original form, state and local governments throughout the United States used first-source agreements to:

“require private companies that receive public monies to agree to use the public sector (or its designated contractors) as the ‘first source’ for job hires. The state or local government acts as the ‘job developer’ on behalf of the private firm, identifying and screening potential workers, arranging training services, and so forth” (Schweke, 1999, page 1).

North Carolina’s version for biopharmaceuticals differs slightly, in that employer training needs, rather than public subsidies, are used as leverage for negotiating these arrangements.

As one example, a rural-based college recently modified its version of BioWork in order to better reflect the skills needs of regional employers (Lowe, 2007). This particular county is home to more traditional pharmaceutical firms that use chemical-based, rather than biological-based, production processes. In response, the region’s community college replaced biology-related modules of the original BioWork course packet with specialized training units in chemical mixing, solid dose tableting, and coating. In exchange for modifying the program, the county’s four chemical-based manufacturers guarantee interviews with BioWork graduates from the college for all relevant job openings. While this does not guarantee a job offer, it still provides BioWork participants in the county with a leg up in the application screening process. It also enables college instructors and career counselors to request company and student feedback on the interview process. When job placement goals are not met, human resource managers provide insights on the hiring process that can be used to improve the next round of training and job placement support. The college has been approached by instructors at neighboring exurban schools requesting similar job placement assistance for recent exurban program graduates.

In a related example, a large-scale biopharmaceutical firm in an exurban county agreed to reserve job interviews for top BioWork graduates. This can represent approximately 15% of program graduates each semester. In an effort to improve employment opportunities for initially underperforming students, the company and college established a concurrent tutoring program for BioWork students that scored below the 10th grade level in reading and math—company employees often gave strong employment recommendations for the students they had tutored (Lowe, 2007). While this tutoring program is now under the direction of the college, other mechanisms are in

⁽³⁾ It should be noted that in an earlier survey analysis we classify only four of seven colleges as intermediaries (Goldstein et al, forthcoming). For the analysis here I have included one additional urban college as they provide intermediation support outside of biopharmaceuticals, but in related production industries, including food processing and cosmetic manufacturing.

place to maintain the strong college–company relations on which this program was initially built. For example, BioWork instructors with previous employment experience at the company maintain their connections to human resource managers, who are invited to meet with BioWork students and assist with resume writing and interview preparation.

BioWork administrators from these and other intermediary colleges are working to extend this model by identifying other regional employers that are in need of customized training and employee recruitment support and thus potentially open to similar employee referral arrangements. In some cases new targets include firms outside of biopharmaceuticals, though in regulated industries that use related manufacturing processes and work standards. A rural-based college, for example, entered into negotiations with an auto-parts supplier that specializes in chemical-based production processes. They were able to build on the BioWork curriculum in order to create a specialized training program for that firm's incumbent and prospective employees. Similarly, the exurban college mentioned earlier that provides specialized BioWork tutoring has taken additional steps to offer a customized version of BioWork to a large cosmetics manufacturer in the region. These efforts point to additional opportunities for institutionalizing and extending local hiring commitments to other industries.

In addition to establishing employee referral agreements, intermediary colleges also develop less-formal methods for helping their students to gain access to jobs at biopharmaceutical firms (Lowe, 2007). As one example, they use frequent meetings with local biopharmaceutical facility staff and supervisors to track anticipated job openings at companies in their service area. This information, combined with existing knowledge of individual company skills needs, allows them to better prepare students for company-specific job application writing and interviewing. Similarly, they schedule facility tours and speaker events with companies that they know are in expansion mode.

As mentioned earlier, job seekers with traditional industry backgrounds often perform less well during the job search compared with their counterparts with microelectronics industry experience. Interestingly, students enrolled at colleges that act as workforce intermediaries by offering industry-specific job placements and job networking support are helping to level the playing field. Our survey results provide strong evidence for this. Some 43% of job applicants from intermediary colleges secured job offers at biopharmaceutical facilities. In contrast, only 18% of applicants from nonintermediary colleges secured similar job offers. Furthermore, for those with traditional industry backgrounds, 50% of applicants from intermediary colleges received job offers in biopharmaceuticals, compared with no offers for those with similar backgrounds applying from nonintermediaries. This suggests that completing BioWork at an intermediary college provides an additional employment advantage for the displaced and disadvantaged job seeker.

Institutional reinforcements

Reciprocal arrangements of the kind mentioned above are not only designed to expand regional employment opportunities, but also offer biopharmaceutical firms an immediate solution to pressing employment challenges. In the case of the previously mentioned rural first source example, pharmaceutical firms in the region initially had difficulty recruiting and retaining qualified employees. BioWork has increased the number of eligible job applicants, thus reducing the need for firms to lure workers away from other regional employers. At the same time, this program has helped firms lower employee turnover rates by giving prospective job candidates a more accurate understanding of initial employer expectations and job requirements. For the exurban

employer mentioned above, BioWork initially provided a cost-effective retooling device for transitioning existing employees from traditional, chemical-based manufacturing divisions to bioprocessing. By helping firms design and implement effective solutions to these regional employment challenges, colleges are in a position to advocate on behalf of less-advantaged socioeconomic groups.

Once these challenges are resolved, however, one could easily envisage individual firms having little incentive to continue to uphold their end of the bargain. Furthermore, with the growing availability of BioWork at neighboring colleges and, thus, expansion of regional training and hiring sources, firms are becoming less dependent on individual colleges. This only increases the chance they could renege on established partnerships and employee referral arrangements with local colleges. Still, despite such alternatives, biopharmaceutical manufacturers have actually remained committed to working with local colleges in their region. What explains this sustained commitment?

To answer this question we need to step back from the individual college to also consider efforts by state agencies to support college-level intermediation strategies by continuously updating biopharmaceutical training options. At the core of this effort is a dynamic government–industry partnership that helps intermediary colleges identify and respond to emerging regional employment challenges and initially unmet training needs. Using a mix of strategies, training specialists from state agencies, including the North Carolina Biotechnology Center and North Carolina BioNetwork, are in a position to identify emergent employment challenges in biopharmaceuticals. They do so by gathering detailed industry information through a number of different channels. The state-sponsored Biotechnology Center, for example, conducts in-depth occupational surveys with biopharmaceutical human resource managers every five years or so, dating back to the mid-1990s. These surveys track industry employment changes and emergent skills needs. They also provide a detailed occupational profile of the industry, breaking down individual occupations by their job entry requirements, such as minimum years of schooling, vocational training, or work experience. Similarly, they collect information for multiple, consecutive years, thus capturing changing hiring criteria. In addition to these surveys, industry focus groups and networking events are also scheduled by the Biotechnology Center in conjunction with specialty industry associations. These provide an opportunity for state training specialists to learn more about industry-specific employment challenges and training needs.

These information-gathering exercises and networking events complement efforts by intermediary colleges to shape local hiring practices. Colleges, with support from state agencies, have used industry information to promote regional skills recycling. Occupational surveys were initially used to develop BioWork training modules and establish program entrance exam requirements. These surveys also provide college administrators and training specialists with detailed occupational information that is used to identify potentially overlapping skill needs in traditional and emerging manufacturing industries. As a result, they are in a position to work closely with displaced traditional industry workers to help them better to market their existing skills sets when applying for positions in biopharmaceuticals.

At the same time, these informational exchanges also help shape firm behavior. During focus groups and networking sessions, biopharmaceutical firms have learned from one another that university graduates, namely those with bachelor's degrees, have tended to leave entry-level manufacturing jobs within a few months, because they either identify better opportunities for occupational advancement or view this type of work as menial and unchallenging. In contrast, high school degree holders are said to be more 'loyal' and 'committed' to manufacturing jobs. Still, challenges exist when hiring less-educated workers, which biopharmaceutical firms openly discuss

at meetings and events. This information has been used by training specialists to create additional modules to help less-educated job seekers overcome initial weaknesses in math, science, and reading and thus remain competitive in the job search. One example is 'Biotech Bootcamp' which feeds into the BioWork course—students receiving a low score on BioWork's entrance exam are encouraged to first enroll in this free semester-long course. In addition, these exchanges have resulted in the formation of more-intensive follow-on modules in cGMP and clean-room procedures, among others, that are offered at the BioNetwork Capstone Center, a regional training center serving multiple BioWork colleges. By identifying specific skills gaps and addressing them through supplemental training modules, state training specialists have been able to reinforce efforts by intermediary colleges to convince biopharmaceutical firms to adopt more inclusionary hiring strategies.

On the one hand, there is some risk that the development of these additional training modules and follow-on courses allows biopharmaceutical firms to simply replace training normally provided and financed in house with publically subsidized external support. This raises a question about a possible 'substitution' effect. On the other hand, there is the question of training control and whether biopharmaceutical firms are willing to relinquish in-house training responsibility which is typically firm specific and thus a factor in employee retention—by outsourcing training to colleges that cater to multiple firms, there is some risk that skills learned externally are transferable to other biopharmaceutical facilities and thus may increase employee turnover. To offset these competing logics the community college system works closely with BioWork colleges to coordinate both general *and* customized training supports in biopharmaceuticals.

Intermediary colleges, especially given their frequent interaction with biopharmaceutical firms, are in a strong position to match up these two types of training support. Intermediaries work closely with established firms to develop fee-based customized training options, at times acting as institutional brokers that negotiate lower training fees from specialized equipment vendors. Still, this customized work also feeds into general course development, especially when multiple firms require similar training support. The community college system, as a repository of information on customized training, works with colleges to identify overlapping training needs. Both also turn to biopharmaceutical firms to solicit feedback on new general course development. Meetings involving multiple firms are especially helpful in reinforcing shared skills needs and also allow participating firms to openly discuss industry-wide benefits to enhanced training support, thus lessening concerns about interfirm labor competition (Lowe, 2007). At the same time, by continuously updating their general course offerings the community college system helps to reduce potential underinvestment in training by biopharmaceutical employers, yet also empowers intermediary colleges to harness their role in training program development as an added source of bargaining power.

Broadening the industry focus

Still, by reducing educational hiring criteria and extending modular vocational training options, state agencies and community colleges may inadvertently contribute to industry deskilling or polarization by trapping less-educated workers in lower paying, entry-level positions that offer few opportunities for internal or external career advancement. Fortunately, training specialists, along with college administrators, are not blind to this less-desirable outcome. It is here that they are now focusing considerable policy attention and strategic resources.

Several strategies are used by intermediary colleges to encourage less-educated job seekers to expand their job search outside of biopharmaceuticals and with the goal of improving opportunities for career advancement. As mentioned earlier, cosmetic, food processing, auto-parts, and chemical-based manufacturers in the state have not only expressed an interest in hiring workers with BioWork training, but in some counties are actively advertizing job openings to BioWork participants. This reflects overlapping industry skill requirements. As with drug makers, cosmetic manufacturing often needs to adhere to strict federal manufacturing standards established by the Food and Drug Administration, especially for skincare products that contain regulated ingredients like sunscreen and retinol acid. Similarly, food and beverage makers often utilize related manufacturing processes, such as fermentation and sterilization.

As mentioned earlier, some colleges are developing customized or modified versions of BioWork for these specific types of firms. To enhance these efforts, colleges are also educating BioWork participants about these additional regional employment opportunities. BioWork instructors invite cosmetics and food processing industry representatives to meet with BioWork students. They also schedule class tours at local skincare and beverage manufacturing facilities. Finally, they keep track of former BioWork students at these types of facilities and highlight their experiences during career development sessions. Combined, these promotional efforts are especially important given opportunities for career advancement for less-educated BioWork graduates at these facilities. In contrast to many biopharmaceutical firms that often require workers to complete degree programs before advancing to higher ranking positions, firms of this type tend to provide greater opportunities for internal advancement based on job performance and on-the-job training.

Surveys of BioWork students enrolled in the spring 2006 class indicate awareness of these types of employment alternatives. Several students, when asked to list their ideal employer, indicated a strong interest in securing work at North-Carolina-based divisions of Pepsi, Revlon, and natural skincare product manufacturer, Burt's Bees. Our post-BioWork survey results also demonstrate that the inclusion of these additional industry targets helps to improve the employment prospects of less-educated job seekers. While 25% of job applicants with a high school degree plus some basic vocational training received job offers in biopharmaceuticals, 38% from this less-educated labor pool secured job offers when factoring in applications to both biopharmaceuticals and related industries that draw on similar production processes.

Concurrent strategies are also used to encourage less-educated BioWork graduates who do secure entry-level employment in biopharmaceuticals to utilize additional educational supports as a means to further advance their careers in life sciences. With this goal in mind, two colleges in the state now allow BioWork graduates to apply course credit for the program towards a two-year associate degree in biopharmaceuticals. This has not been without its challenges, though, as linkage agreements of this kind essentially require breaking down traditional barriers between college curriculum and continuing education divisions. Still, the ability of these colleges to establish linked credit programs is encouraging and provides others with a successful model to follow when designing similar course credit options.

At this point it is important to return to the perspective of the higher educated job seeker. As a result of relaxed educational standards and shifting hiring criteria, these trainees may actually face their own employment barriers as biopharmaceutical firms take steps to actively limit the number of entry-level job offers to university degree holders. To some extent the survey results capture this threat and indicate that highly educated job seekers actually perform worse in their biopharmaceutical job search compared with applicants with lower levels of education—only 27% of job applicants

with bachelor's degrees or higher actually secured offers in biopharmaceuticals. This obviously raises concerns about potential talent underuse for the industry.

To address this challenge, intermediary colleges encourage higher educated BioWork students to also broaden their posttraining job search in an effort to secure higher ranking positions in both biopharmaceutical manufacturing and other fast-growing segments of life sciences, including contract and clinical research. This is achieved by helping students review part-time and temporary employment opportunities that can give them immediate life science industry experience and thus improve their long-term job prospects. BioWork instructors and program coordinators refer to these as 'bridging jobs', insofar as they help more highly educated students apply their existing cognitive skills and previous technology experience to life-science-oriented activities. In order to help these students secure bridging jobs, program coordinators often request assistance from life-science-focused staffing and temporary employment agencies in the area. This is especially true for urban-based colleges that rely on these agencies to help their students gain access to short-term scientific research projects at regional health care facilities and research universities. This strategy not only helps more highly educated workers to secure better positions in life sciences, but also helps to reduce unnecessary job competition with less-educated job seekers. Related to this, these strategies help more highly educated workers to better cope with temporary industry downturns and hiring freezes, thus eliminating the need to search for backup jobs at lower ranking levels.

Community colleges and intermediation

Community colleges in North Carolina are using intermediation strategies to help diverse groups of job seekers secure manufacturing jobs in biopharmaceuticals and related industries. These strategies include negotiating local hiring and employee referral arrangements, working with state agencies to influence and reinforce industry-wide hiring preferences, targeting employers outside of biopharmaceuticals, but still in industries that use related production processes, and assisting job seekers to identify and harness transitional employment and follow-on educational opportunities. Combined, these efforts influence not only the job search strategy of BioWork participants, but also the hiring criteria of regional biopharmaceutical employers. In turn, this is helping less-educated job seekers to maintain a foothold in manufacturing, despite North Carolina's continued loss of traditional manufacturing jobs. Similarly, these efforts help connect more highly educated job seekers to diverse life science employment opportunities that match well with their existing educational qualifications and work experience.

The adoption of workforce intermediation strategies by community colleges in North Carolina holds considerable promise for other states and localities throughout the United States. Given historically low levels of union representation in the US South, this case highlights an alternative institutional channel for improved worker advocacy. Still, its labor market contribution is not isolated to the South. In other contexts, college-led intermediation also presents an alternative institutional vehicle for advocating on behalf of less-privileged socioeconomic groups (Gilothe, 2004). Community college systems throughout the United States are well positioned to act as intermediaries given their existing work with low-income and disadvantaged populations through established adult literacy and remedial education programs (Osterman, 2007). Equally, they have gained the respect of business owners and managers in their respective jurisdictions through ongoing support for customized and industry-oriented vocational training (Osterman, 2007; Osterman and Batt, 1993).

College-backed intermediation also presents a possible solution to the current US economic slowdown which has resulted in job losses for workers in once-secure occupational categories—namely, those held by workers with advanced degrees and considerable professional and technical work experience. By incorporating intermediation strategies into universal educational systems—ones that are open to the general public rather than specific target groups—community colleges are in a position to reach a broad array of job seekers and thus to respond to emerging economic challenges that cross traditional socioeconomic lines. As illustrated for North Carolina, a universalist approach has not only resulted in job opportunities for less-advantaged job seekers in the state, but has also helped resolve a previously unanticipated labor market challenge—namely, the displacement of more highly educated tech workers in the wake of the 2001 technology crisis.

Still, trying to balance the needs of diverse groups of job seekers is not without its own challenges and would require careful planning and intercollege coordination (Gilothe, 2000; Osterman, 2007). In this regard North Carolina's college-led intermediation experiments are also vulnerable. The current economic environment only intensifies the performance pressures on individual colleges in the state. These colleges need considerable resources and dedicated staff to allow them to customize and coordinate training and job placement services. These resource needs will likely increase in the current economic climate as their availability is curtailed, at the same time that growing numbers of job seekers—more and less educated—turn to community colleges for transitional training support. Additionally, in order to maintain their influence on local labor markets, intermediary colleges also need industry and employer commitment to recruit workers through college-sponsored training programs. In a tightening labor-market environment, such as the one that existed in North Carolina when intermediation strategies initially took hold, employer buy in was easy to secure. As economic conditions change, however, and more job seekers enter the labor market, colleges could lose their labor-market power and thus face greater challenges in advocating for less-privileged job seekers. As one illustration of this, third-party private staffing agencies have recently emerged as local competitors for some intermediary colleges, helping employers identify job candidates with previous biopharmaceutical work experience and thus fewer immediate training needs. The full implications for intermediary colleges is difficult to assess at present, but nonetheless suggests the need for additional support for strengthening and reinforcing intermediation strategies. These challenges also suggest the need for other states to consider this new economic environment as they develop their own intermediary strategies and, specifically, whether to initially adopt a universal or targeted approach.

As indicated earlier, workforce intermediation efforts in North Carolina's biopharmaceutical sector are grassroots and reflect bottom-up initiatives adopted by a handful of pioneering colleges (Lowe, 2007). While state-wide support does exist to bolster these localized experiments, it is still the responsibility of individual colleges to harness this assistance. The next challenge is deepening system-wide support for extending intermediation in order to ensure current strategies withstand this turbulent economic period. Extended support of this kind in North Carolina and elsewhere will help to institutionalize workforce intermediation as a tool for regional economic transition and resilience.

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