

# CAROLINA context

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## THE PROGRAM ON PUBLIC LIFE

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## DIRECTOR'S NOTE

This issue of Carolina Context presents a case study of job-training for North Carolina's life science manufacturing industry. It is an insightful study of sector-based training, which has emerged as a strategy for responding to the swift and dramatic transformation of the state's economy.

Dr. Nichola Lowe, assistant professor in the UNC-Chapel Hill Department of City and Regional Planning, focuses her research on issues related to economic development and has written extensively on North Carolina's life science manufacturing industry. This white paper is drawn from two of her academic studies.

As North Carolina's economy has diversified, so its job-training enterprises have had to adapt to a more diverse occupational mix. The state's job-training challenges now range from preparing low-income people, the marginally literate and new immigrants for entry-level jobs to assuring that the state has enough well-trained people in its labor market to fill the demand created by businesses offering high-skill, well-paying jobs.

In its recently released "State of the North Carolina Workforce" report, the state Commission on Workforce Development finds that "middle jobs" that require a modicum of education but pay enough to sustain a family are disappearing and that the impending retirement of baby-boomers will deplete labor talent. The report warns of the potential of "an increasingly polarized workforce — those who have skills and access to good-paying jobs and those without skills and only access to primarily lower-paying jobs."

As North Carolina made its earlier transition from a farm-and-small factory economy to an economy with a strong mix of services, research and higher-tech manufacturing, the state deployed job training as an integral part of its economic development strategy. The state created a community college system that spans the state,

and those colleges offered customized training to businesses and industries moving into North Carolina.

Customized training has considerable strengths and remains in use as a benefit for workers seeking better jobs and as an inducement to industries to locate in North Carolina. Now, as North Carolina seeks to foster "clusters" of related enterprises, the state has also moved increasingly toward a sector-based strategy in job training. Sector-based strategies focus not simply on a single business or industry, but rather a set of enterprises spread over a region. Such strategies seek to develop expertise in specific types of industries and then to use that expertise to develop strong worker training mechanisms.

Sector-based strategies are not new to North Carolina. They include an advanced materials cluster in the northwest as well as the training for life science manufacturing documented in this white paper. The success so far of the life science manufacturing effort, documented by Professor Lowe, was not accidental and has been the result of deliberate efforts by the state to build and sustain North Carolina's competitive advantage in this area.

By presenting this case study of a sector-based strategy, we hope to contribute to the furtherance of informed policy making in economic development and job-training in North Carolina.

The full text of her published papers and other materials on sector-based strategies will be available on our web site, [www.southnow.org](http://www.southnow.org). We would like to thank Joe Hauser, Chair of the Wilkes Community College Industrial Services and CIT Division, and Kathleen Kennedy, Vice President of the NC Biotechnology Center Education and Training Program, for their assistance with this paper.

— FERREL GUILLORY

*Director, Program on Public Life*

# Life Science Manufacturing in North Carolina: *A Case Study for Workforce Development*

According to North Carolina's biotechnology center, the state is home to approximately 50 large-scale life science manufacturing plants. These establishments fall under two broad manufacturing categories: (i) biomanufacturing and pharmaceutical manufacturing facilities that produce drug therapies and (ii) contract manufacturing facilities that offer specialized manufacturing services to bio-pharmaceutical establishments.

Employment in this sector is approximately 16,000, with job growth averaging 10% per year since 1990.

Media coverage of this development tends to focus on state and local industry recruitment efforts; however, there are other factors that contribute to the growth of this sector. Two less publicized efforts are underway to help support newly recruited firms and also guide the expansion of home-grown facilities. First, community colleges have used their expertise in vocational training and job placement services to shape worker training and firm hiring practices. In the process, college administrators and instruc-

tors are helping residents with low-levels of formal education secure jobs at bioprocessing and pharmaceutical plants—this includes workers displaced from traditional and declining manufacturing industries like textiles, furniture and micro-electronics. Second, state development agencies—including North Carolina's Biotechnology Center and the state's Department of Commerce—work closely with existing manufacturers to identify common industry challenges and to help build a life science manufacturing "cluster."

### A DYNAMIC CURRICULUM

Today, North Carolina's life science workforce development system is composed of three types of training supports: (i) associates degree programs; (ii) semester-long continuing education courses; (iii) day and week-long specialty training sessions. Community colleges have played a central role in the development of this system.

More than 20 of the state's community colleges offer a two-year associate degree in

**Table 1: North Carolina's Life Science Manufacturers**

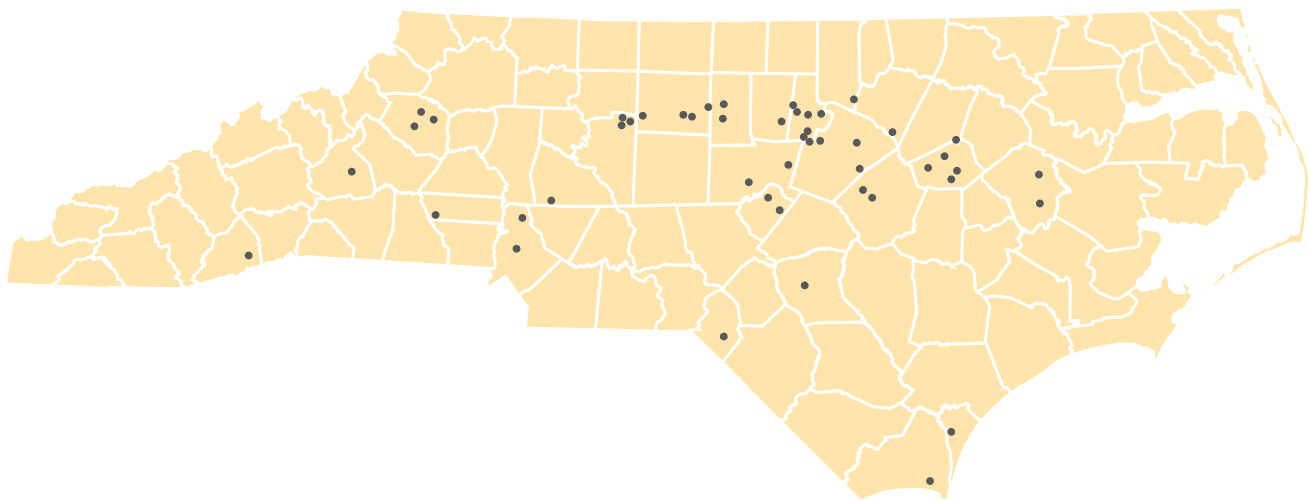
TYPE	TOTAL
Biomanufacturers	16
Pharmaceutical Manufacturers	19
Contract Manufacturing Organizations	9
Medical Device Manufacturers	185

*Source: North Carolina Biotechnology Center, 2005; North Carolina Medical Device Organization 2006. Note: The average medical device manufacturer is small sized, employing around 10 workers. In contrast, most bio/pharma manufacturers in North Carolina are medium and large sized operations.*

biopharmaceuticals or related fields. Forsyth Technical Community College has the largest associate's program in biopharmaceuticals, with an annual enrollment rate of more than 200 students, many of whom complete their degrees through regional college partnerships. North Carolina's biopharmaceutical-related associate degree programs have increased 234 % in the past five years, from 370 to 866 students.

In addition, community colleges offer continuing education courses, including BioWork,

**Map 1: Bioprocessing and Pharmaceutical Manufacturers in North Carolina**



*Source: North Carolina Biotechnology Center, 2005*

**Table 2: Biomanufacturers operating in North Carolina**

COMPANY	PRODUCTS	LOCATION
Ajinomoto USA	Amino Acids	Raleigh
AlphaVax	Vaccines	Durham
Archer Daniels Midland	Citric acid	Southport
Argos Therapeutics	Therapeutic vaccines	Durham
Biogen Idec	Multiple sclerosis and psoriasis drugs	Research Triangle Park
Biolex	Therapeutic proteins	Pittsboro
Corn Products International	High-fructose corn syrup and starch	Winston-Salem
Diosynth RTP	Contract biopharmaceutical manufacturing	Research Triangle Park
Embrex	Poultry vaccines	Laurinburg
Greer Laboratories	Allergenic extracts, vaccines	Lenoir
KBI BioPharma	Contract biopharmaceutical manufacturing	Durham
Merck & Co.	Vaccines	Durham
MWG	Synthetic nucleic acids	High Point
Newco Plasma Services Biotherapeutics	Blood and plasma-related therapeutics	Clayton
Novozymes	Industrial enzymes	Franklinton
Wyeth	Vaccines Vaccines	Sanford

Source: NC Biotechnology Center Company Directory, as listed in October 2005

**Table 3: Manufacturers of Pharmaceuticals and Diagnostics operating in North Carolina**

COMPANY	PRODUCTS	LOCATION
Alpharma USPD	Pharmaceuticals	Lincolnton
Banner Pharmacaps	Pharmaceutical gel caps	High Point
Baxter Healthcare IV	Systems Intravenous solutions	Marion
Bespak	Drug-delivery devices	Apex
BioMerieux	Diagnostic kits	Durham
Carolina Medical Products	Ointments, powders, non-injectable solutions	Farmville
Cytosol Ophthalmics	Sterile balanced salt solutions	Lenoir
Eisai Pharmatechnology	Alzheimer's drug	RTP
Eon Labs	Broad range of products in solid, oral dosage forms	Wilson
GBF Medical Group	Diagnostic kits	Greensboro
GlaxoSmithKline	Drug formulation and packaging	Zebulon
Hospira	Injectable solutions and drugs	Rocky Mount
Leiner Health Products	OTC pharmaceuticals	Wilson
Medtox Diagnostics	Drug testing kits	Burlington
Merck Manufacturing	Pharmaceuticals	Wilson
Microban Products	Anti-microbial polymeric additives	Huntersville
NittaGelatin USA	Gelatin powder for pharmaceuticals and food	Fayetteville
Novo Nordisk Pharmaceutical Industries	Human insulin formulation and sterile filling	Clayton
Purdue Pharmaceuticals	Pain relief and asthma drugs	Wilson
Shionogi Qualicaps	Pharmaceutical gel caps	Whitsett
TriPath Imaging (+ TriPath Oncology)	Medical reagents	Burlington (Durham)
Tyco Healthcare	Mallinckrodt Acetaminophen	Raleigh
Vintage Pharmaceuticals	Pharmaceuticals	Charlotte

Source: NC Biotechnology Center Company Directory, as listed in October 2005

a 128-hour, semester-long certificate course that provides students with entry-level process technician skills for both biomanufacturing and chemical-based pharmaceutical manufacturing. BioWork training modules focus on a range of topics from safety and quality control to process sterilization and growth of living cells. More than 900 students enrolled in BioWork in 2005, an increase of 241% since its first open enrollment offering in 2001. In addition, employed workers complete BioWork modules during annual training sessions that last one or two weeks.

Students enrolled in the state's curriculum

programs and those who have completed BioWork are also eligible for intensive day- and week-long applied biopharmaceutical courses in Current Good Manufacturing Practices (cGMP), clean room operations and endotoxin detection and monitoring. These courses are offered at Wake Tech Community College. Enrollment—which currently stands at 166 students—is anticipated to increase considerably with the 2007 opening of the BioNetwork Capstone Center at North Carolina Central University. This \$34 million training center—the largest of its kind in the United States—simulates a pilot plant bio-

manufacturing facility in order to provide both community college and university students with hands-on experience in bioprocessing, quality control and plant maintenance.

#### A NEW TYPE OF PARTNERSHIP

Life science manufacturing firms have shifted from relying on in-house training to relying on community college-based programs. BioWork was instrumental in this change. This semester-long certificate course was the outgrowth of a formal partnership established between the North Carolina Biotechnology Center and the

**Table 4: Community College Life Science Curriculum and Vocational Training Programs**

CURRICULUM PROGRAMS	STUDENT ENROLLMENT				
	2001-02	2002-03	2003-04	2004-05	2005-06
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

CONTINUING EDUCATION PROGRAMS	STUDENT ENROLLMENT				
	2001	2002	2003	2004	2005
BioWork: Process Technician Training	374	274	761	559	903

BIONETWORK CAPSTONE COURSES	STUDENT ENROLLMENT	
	ALL YEARS	
cGMP, Aseptic Manufacturing, Bacterial Endotoxin Detection, Operations in Biotech Processes	166	

Sources: North Carolina Community College System Data Warehouse (Curriculum and Continuing Education Programs) North Carolina BioNetwork (BioNetwork Capstone Courses).  
 Note: Curriculum "Reporting Year" begins with Fall and ends with Spring. Continuing Education Programs "Reporting Year" covers Spring, Summer, Fall.

state's Community College System in 1998. This partnership encouraged involvement by larger pharmaceutical and biomanufacturing firms from the state. The Biotechnology Center had already solicited input from these companies in the

mid-1990s when it conducted a firm-level survey through which it was able to identify growing demand for process technician skills in the state. Curriculum development for BioWork helped to deepen this public-private exchange. Human

resource managers at Novozymes, for example, worked closely with vocational training specialists from the Biotechnology Center to design the original BioWork program. Novozymes not only agreed to pre-test a pilot version of BioWork on its employees, but also reviewed job applications from trainees who completed the first semester of the program at Vance Granville Community College in 2001. This resulted in another round of revisions to the original course design, including the addition of job placement modules on resume writing and interview preparation.

Today, 12 of North Carolina's 58 community colleges offer versions of BioWork 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. Distance learning versions of this program now enable students from non-BioWork counties to complete part of their coursework on-line and by attending weekly laboratory training sessions offered at neighboring colleges.

By focusing on the community colleges to train its workers, life science manufacturers have contributed to the creation of a sector-based workforce development system. In an in-house, employer-based model, firms often have little incentive to train more than is required for a given job. From the firm's point of view, the more supplementary skills an employee has, the easier it is for her to be lured away by another

**Table 5: Regional Comparison of BioWork Students, Spring 2006**

	URBAN COLLEGES	EX-URBAN 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 college degree or higher	41%	17%	24%
Share of students with a 4 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:**  
 Urban Colleges: Microelectronics; Chemicals; Auto-parts/Auto-motive  
 Ex-urban Colleges: Auto-parts/Auto-motive; Textiles; Microelectronics  
 Rural Colleges: Textiles; Chemicals; Auto-parts/Auto-motive

**Table 6: North Carolina Community Colleges Offering BioWork**

COUNTY(S)	COMMUNITY COLLEGE	STARTING YEAR
Granville, Franklin, Warren, Vance	Vance-Granville Community College	2001
Johnston	Johnston Community College	2001
Wake	Wake Technical Community College	2002
Durham	Durham Technical Community College	2002
Carwell, Person	Piedmont Community College	2002
Chatham, Lee, Harnett	Central Carolina Community College	2002
Pitt	Pitt Community College	2003
Wilson	Wilson Technical Community College	2003
Buncombe, Madison	Asheville-Buncombe Technical Community College	2004
Cumberland	Fayetteville Technical Community College	2004
Guilford	Guilford Technical Community College	2005
Lenoir, Greene, Jones	Lenoir Community College	2006

Source: North Carolina Community College System, 2006.

facility. This forces employees interested in gaining supplement skills to invest in training on their own.

By reorienting their training systems and partnering with community colleges, life science manufacturing firms have helped create an infrastructure for a sector-based strategy in which each of the three interested parties comes out ahead. Workers develop skills that are applicable across the sector; community colleges serve their public function; and firms gain access to well-trained workers.

#### FILLING A SKILLS GAP

This training partnership has worked because the community colleges have been willing to think outside their traditional roles. N.C. community colleges have expanded beyond worker training to offer a wide array of job placement and career development services. The colleges' willingness to juggle the needs of multiple clients (i.e., local employers, displaced workers, recent high school graduates etc.) puts these institutions in a unique position to negotiate with firms and to expand employment opportunities for disadvantaged groups. Their reputation as educators and their ability to offer top-quality, state-of-the-art training enable them to influence who gets access to good paying jobs in the life science industry and how life science firms themselves value a region's workforce.

The blurring of boundaries between industry and publicly-funded colleges might lead some to raise concerns about the ability of educators effectively to balance the needs of workers/students with those of employers. Interestingly, however, the deepening of ties with life science manufacturers seems to have opened up opportunities for state officials and educators to push firms to modify hiring practices and preferences in ways that benefit less educated job seekers from the region. For example, Wilson Tech was willing to customize programs to reflect the needs of local manufacturers, which essentially gave it greater bargaining power when making demands for more inclusionary employment review processes. Wilson Tech has essentially created a first-source hiring agreement, whereby a public-sector organization, in this case a college, act as de facto employment agency.

Similar efforts have helped specifically to keep open life science employment opportunities for high school degree holders. As Table 7

indicates, roughly 60 percent of jobs at an average life science manufacturing establishment in the state are available to high school diploma and GED certificate holders. This is somewhat surprising given on-going industry changes that elsewhere have resulted in hiring practices that favor workers with bachelor's degrees.

Through their frequent interaction with local firms, training specialists from the state have developed a sophisticated understanding of the specific skill requirements of and training needs for each job category in life science manufacturing. By organizing industry focus groups and conducting regular surveys with human resources managers, training specialists from the state have also been able to track changes in skills requirements overtime and assess future industry skill needs. This, in turn, has resulted in the design and redesign of specialized courses and inter-locking training modules. Rather than addressing potential skills shortages by bumping up the formal degree requirements of potential job applicants, firms in North Carolina have built on their relationships with local community colleges to respond to skills gaps by co-developing and piecing together customized training modules. Under this system, firms are assured follow-up training support for workers who enter with lower levels of formal schooling. BioWork is but one piece of this customized training chain. While BioWork only provides basic, entry-level skills, companies view participation in the program—especially by GED and high school degree holders—as a sign of an applicants openness toward and willingness to complete additional rounds of firm-specific training.

**“By focusing on the community colleges to train its workers, life science manufacturers have contributed to the creation of a sector-based workforce development system.”**

This incremental approach to skill development has a second, related benefit for local manufacturing. It has provided manufacturing firms with a solution to a growing industry chal-

lenge—high worker turnover, especially among those with a bachelor's degree. According to industry executives, bachelor degree holders often apply for biomanufacturing positions in order to gain entry into the industry. It is rare for these

**“...training experts and intermediaries from the state have an opportunity to shape local hiring practices in ways that continue to favor traditionally disadvantaged groups with low levels of formal education.”**

workers to remain in these positions for more than a few months due to internal promotion, “poaching” by other life science manufacturing operations and the lure of cutting edge work at other establishments.

In contrast, manufacturing firms find that high schools diploma holders remain “loyal” to their job and employer. By relaxing formal educational requirements and using incremental training to address skills shortages, larger employers in the state have been able to lower turnover rates and thus stabilize their workforce. At the same time, they have been able to expand the pool of eligible job candidates and, in the process, address some of the challenges associated with a tightening local labor market in life sciences.

Training experts from the state recognize that industry pressures for continued skill development may eventually limit employment opportunities in life sciences for high school degree holders. Recent surveys of human resource managers now indicate a growing preference for two year Associate Degrees across all levels of manufacturing. According to industry experts, workers with an Associate Degree are more easily moved from one type of job category to another and therefore enable firms to respond quickly to unanticipated shifts in demand or production-related regulatory decisions. Still, until these programs produce large numbers of potential employees, training experts and “intermediaries” from the state have an opportu-



nity to shape local hiring practices in ways that continue to favor traditionally disadvantaged groups with low levels of formal education. This is particularly important given North Carolina's low college completion rates, especially in non-metro counties. At the same time, this provides college educators with an opportunity to test-out and garner state support for innovative strategies that encourage high school graduates to enroll in two-year college curriculum programs with the goal of promoting career advancement in life sciences.

**PARTNERSHIPS IN INDUSTRY EXPANSION AND RECRUITMENT**

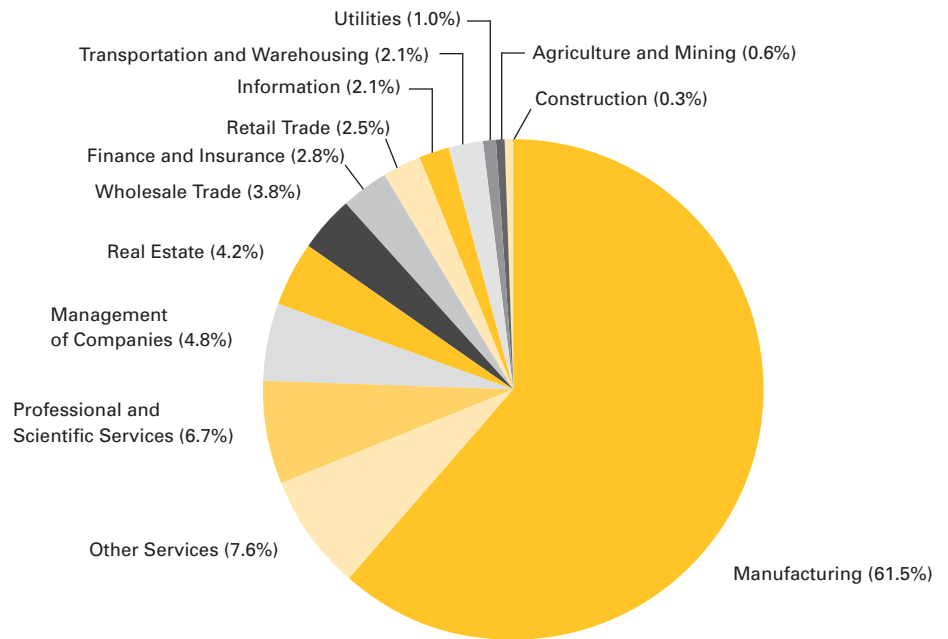
This workforce development system is also used to attract new life science establishments to the state and with it new employment opportunities. This is helping to strengthen the life science sector. Interestingly, life science manufacturers in North Carolina are actively working with state development agencies to help recruit outside manufacturers to the region. They do so by meeting with representatives from prospective firms and in some cases providing guided tours of their manufacturing facilities. According to the operations manager of a Durham-based manufacturing facility, efforts to expand the state's manufacturing base help to justify additional requests for training investments and resources from local foundations and policy-makers and also enables life science executives to recognize and praise the hard work of development practitioners by featuring this as a distinct, regional competitive asset.

This partnership between state agencies and life science manufacturers helps to promote industry expansion by identifying and organizing around other shared challenges--for smaller life science manufacturers, particularly those that started out as home-grown North Carolinian firms, this includes the pressing issue of financing. For larger firms, there are long standing concerns about patent protection and federal-level regulatory approval processes. North Carolina's biosciences industry association, NCBIO, is also an active partner in helping identify possible solutions to these shared challenges.

**INCLUDE MEDICAL DEVICE MANUFACTURING**

Within life science manufacturing industries, public and private industry observers have

**Pie Chart 1 North Carolina Economic Activity of the Biopharmaceutical Industry**



Source: Milken Institute, *Biopharmaceutical Industry Contributions to State and U.S. Economies*.

directed the most resources to biopharmaceutical manufacturing. Learning from the success in these sub-sectors, the state is beginning to consider including medical device makers on its list of industry targets. With this goal in mind, the Biotechnology Center has recently commissioned a study of the state's medical device industry.

Medical device manufacturers produce a range of surgical, diagnostic, assistive, and imaging technologies. According to the most recent U.S. Economic Census, 105 medical device manufacturers employed approximately 7,500 workers in North Carolina in 2002. (This figure does not include employment at "hybrid" operations that manufacturer medical devices but fall within other industry classifications.) In the medical device area, employment has increased by more than 10 % and payroll has increased by almost 20 % since 1997.

For the most part, medical device makers have not benefited from targeted programs designed to promote life science industry growth in the state. Rather, the bulk of this support has gone to firms that are classified as "core" biotechnology facilities, bioprocessing plants or pharmaceutical drug-makers. Efforts are under way to try to change this, namely through the lobbying activities of the newly created North Carolina

Medical Device Organization, itself a division of NCBIO. Economic developers in select regions of the state have also identified device manufacturing as a potential growth industry and as such are working to recruit manufacturing firms from outside the state.

The inclusion of medical devices in targeted industry and workforce development programs is important to job growth in rural parts of the state. North Carolina's medical device manufacturers are fairly evenly dispersed throughout the state, with substantial numbers located in both rural and urban counties. As a result, large numbers of medical device facilities are present in counties that have experienced significant lay-offs in textiles, furniture and micro-electronics in recent years. There are currently 30 device manufacturing facilities in the top 10 counties experiencing textile lay-offs since 1995. By comparison, four biopharmaceutical manufacturers are in those same counties. Similarly, there are 42 medical device manufacturing facilities in furniture-dependent counties, compared with seven biopharmaceutical manufacturers. While many of the state's medical device manufacturing facilities are small in size and may not generate as many jobs as a single biopharmaceutical facility, there is reason to believe that medical device manufacturing is a growing sub-sector

Table 7: Job Categories and Educational Requirements in Biopharmaceutical Manufacturing

JOB CATEGORY	MINIMUM EDUCATION REQUIREMENTS	SHARE OF EMPLOYMENT
<b>PRODUCTION</b>		<b>52 PERCENT</b>
Process Technician	High School/GED plus relevant work experience or training	
Manufacturing Prep Process Technician	High School/GED plus relevant work experience or training	
Formulation/Fill Technician	High School/GED plus relevant work experience or training	
Packaging Technician	High School/GED plus relevant work experience or training	
<b>QUALITY CONTROL</b>		<b>19 PERCENT</b>
Quality Control Assistant	Two-year Associate Degree	
Quality Assurance Assistant	Two-year Associate Degree	
Quality Control Associate	BS Degree	
Process Quality Inspector	BS Degree	
<b>MANUFACTURING SUPPORT</b>		<b>14 PERCENT</b>
Maintenance Technician	HS/GED plus relevant trade certification	
Instrumentation Technician	Two-year Associate Degree	
Environmental Technician	Two-year Associate Degree	
Maintenance Engineer	BS Degree	
Process Control Engineer	BS Degree	
Environmental Engineer	BS Degree	
<b>RESEARCH AND DEVELOPMENT</b>		<b>10 PERCENT</b>
Process Development Associate	Two-year Associate Degree with industry experience	
Process Development Scientist	MS with industry experience or PhD	

*Source: North Carolina Biotechnology Center, 2006.*

and one that that could employ displaced, traditional-sector workers.

A second, related reason for including medical devices in targeted programs and policy efforts has to do with the level of skills compatibility between a typical medical device job and that found in textiles and furniture making. Medical device manufacturers in the state appear to offer more direct channels for skills transference compared to bioprocessing and pharmaceutical manufacturing plants, in part because they have job categories and work environments that are more closely aligned to those in traditional manufacturing. As a result, select jobs require less start-up training and industry-specific experience and therefore would seem to present displaced workers from traditional manufacturing establishments with more immediate channels for career transition.

Medical device firms in North Carolina are growing in number and are absorbing workers from disadvantaged regions. Yet, there is an emerging set of industry challenges that suggest the state should do more to expand this industry. Recent analyses indicate a growing need for upgrading and upskilling on the part of U.S.-based medical device manufacturers in order to make them more resilient to changes in the national and global economy—this includes firms that are

based in North Carolina. Related to this, device makers that once produced standardized goods are now under increasing pressure to innovate and in the process shorten product life cycles. To cope with these pressures, device makers are starting to increase worker involvement in technology development and design. As a result, regional skills gaps may eventually emerge as a serious threat to long-term job stability.

In parts of North Carolina, we are beginning to see the effects of this change. In an interview with one firm, a manager noted that recent job applicants tend to be displaced from younger technology industries, like telecommunications and electronics and not textiles—as indicated above. These “tech” employees have had a hard time transitioning to more physically demanding jobs in device-making and have turned over more quickly. To address this issue, the company is considering automating large sections of production through the use of robotics. While this will likely result in greater “firm loyalty” by local “tech” workers, including those with experience in computer programming and robotics maintenance, it also means the loss of those job categories that offer the greatest employment fit for displaced traditional industry workers in the state.

Unfortunately, this is not the only case in which a North Carolina-based medical device

firm has considered eliminating good-paying manufacturing jobs. Another facility in the greater RTP is in the process of off-shoring assembly jobs to Mexico. Plant managers acknowledge this move south may result in additional job losses for other manufacturing workers in North Carolina, including highly skilled maintenance mechanics and machinists. Interestingly, the decision to outsource is not motivated by cost-savings alone, but also by the quality of training institutions and concentration of skilled workers in a northern region of Mexico that has a long history of auto-parts manufacturing.

As with the state’s bioprocessing and pharmaceutical facilities, policy makers and development practitioners can play a crucial role by stepping in to shape how firms respond to local labor market pressures. Related to this, they can help firms address emerging skills gaps through customized, mix-and-match models of training for medical devices. They can also help firms strengthen and formalize their relationships with university research centers. Without such targeted interventions, it is likely that job gains in biopharmaceuticals will be off-set by large losses in other, currently overlooked areas of life science manufacturing. ■