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“The Goose that Lays the Golden Egg”?:
The “Bio-Med” Industries of New Orleans

A Thesis

Submitted to the Graduate Faculty of the
University of New Orleans
in partial fulfillment of the
requirements of the degree of

Master of Science
in
Urban Studies

by

Robert Habans

B.A. University of California, Berkeley 2004

December, 2006

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List of Abbreviations

BDRP	Biomedical Research and Development Park
BNOB	Bring New Orleans Back Commission
CBD	Central Business District
CDBG	Community Development Block Grant
CDC	Centers for Disease Control and Prevention
CMS	Center for Medicare and Medicaid Services
CURE	Connecticut United for Research Excellence, Inc.
DHH	Louisiana Department of Health and Hospitals
FEMA	Federal Emergency Management Agency
FQHC	Federally Qualified Health Center
GME	Graduate Medical Education
GMP	Good Manufacturing Practices-compliant Facility
HMO	Health Maintenance Organization
HSC	Health Sciences Center
LCRC	Louisiana Cancer Research Consortium
LGTRC	Louisiana Gene Therapy Research Consortium
LRA	Louisiana Recovery Authority
LSUHSC	Louisiana State University Health Sciences Center
MCLNO	Medical Center of Louisiana, New Orleans
NIH	National Institutes of Health
NOrMC	New Orleans Medical Complex
RPC	Regional Planning Commission

SBIR Small Business Innovation Research Program
STTR Small Business Technology Transfer Program
UNO University of New Orleans
VA Department of Veterans Affairs

Abstract

This thesis addresses New Orleans' "Bio-Med" sector, a broad category that includes biosciences research, health care, biotechnology, and pharmaceutical and medical device manufacturing. Biotechnology, in particular, has emerged as an attractive target for economic development in New Orleans, in Louisiana, and in the nation as a whole. Informed by economic geography and development literature, this research presents a narrative of efforts to foster the Bio-Med industries in New Orleans as a source of economic diversification and employment. Structural economic conditions, as well as a complex and unsettled array of political agendas shaping Bio-Med institutions, underscore a pessimistic view of the potential for biotechnology to generate significant economic impacts. Since Katrina exacerbated these conditions, Bio-Med strategies should direct more attention to the health care industry and specifically to addressing workforce gaps to meet the twin goals of expanding health coverage and providing realistic employment opportunities for underserved populations.

I. Introduction and Definitions

Economic decline has marked New Orleans since the mid-1980s oil price collapse initiated massive job loss and downtown decline. Even before such dramatic local recession, economic development and metropolitan governance proceeded along a path marked by “fragmentation” (Lauria *et al.* 1995, 106). After the bottom fell out of New Orleans’ over-dependence on the oil and gas industries, city officials and private developers increasingly sought to draw on the city’s historically rich tourism industry as an economic development strategy; and tourism has indeed proven vital to the city’s rebound in terms of both downtown redevelopment and employment (Lauria *et al.* 1995). However, tourism’s success – almost axiomatically – has fostered problematic path dependence. Tourism has reshaped downtown to house primarily tourist uses along the riverfront while other areas have declined; and the city’s workforce occupies a plurality of relatively low-paying, insecure jobs in the tourism and hospitality industries, where few opportunities exist for advancement. By the early 1990s, however, state and local economic development agencies had initiated a focus on the biotechnology and biosciences sector as a new engine for economic growth and downtown development.

At least, that was the situation before August 29th, 2005. On that date, Hurricane Katrina sacked New Orleans with massive flood damage, violence, and confusion during its disastrous aftermath. As with nearly every aspect of life in the city, Katrina dramatically altered the structures underlying economic development, as the wholesale destruction of New Orleans’ essential infrastructure, housing, and labor force – as well as the nationwide perception of a bumbling city and state leadership amidst federal neglect – pose an almost impossibly daunting

deterrent to future capital investment. In the months following the disaster several plans emerged, both to guide comprehensive rebuilding strategies and to present a unified front to congressional funding measures. In particular, early economic development frameworks produced by the Bring New Orleans Back Commission (BNOB), Louisiana Recovery Authority (LRA), and the Urban Land Institute sought to foster the tourism and cultural sector as the quickest path to immediate recovery but advanced the biosciences and health care sectors as the most likely source of long-term economic diversification and sustainability. Over the course of an unprecedented mayoral race in the ensuing months, major candidates ubiquitously paid frequent lip service to these industries as factors in both health care reconstruction and economic diversification schemes. At the time of this writing over one year after the hurricane, this focus is gaining traction as early policy frameworks crystallize into more formal plans. Meanwhile, outside of New Orleans, nurturing local biotechnology and biosciences industries has coalesced into a national trend in recent years, owing mainly to the attractive level of investment and the high quality of employment involved, in addition to potential spin-off jobs.

And yet, many uncertainties remain. This thesis attempts to situate biotechnology and biosciences strategies in the New Orleans Region within a broader framework, first within the context of existing literature on the subject and then within in the complex, multifaceted political economies governing the implementation of such an exceptionally interdisciplinary economic project. The opening chapter defines several terms relating to the range of “Bio-Med” industries, an inclusive category into which a broad group of activities taking place in New Orleans have been condensed (BNOB 2006). In the literature review chapter (Ch.2), the first section draws from a cursory review of extensive literature on regional innovation systems – or industrial “clusters” – to sketch out an account of how economic development policies recently have

attempted to shape their constituent regions into loci for internationally competitive, knowledge-intensive, high-technology industries. The review sheds light on the locally “embedded” qualities of the economic geographies into which high-technology industries situate themselves and comments on how academic knowledge on clusters filters down to the policymakers who attempt to foster cluster development. The second half of Chapter 2 hones in specifically on biotechnology and how the industry has concentrated into a select few regions over the course of its relatively short history. Out of the case studies presented, several common characteristics and strategies emerge as necessary to support a successful biotech cluster, including economic diversity, a local capacity for entrepreneurialism, a skilled industry-relevant workforce, a prestigious research university, and an active leadership structure. The third and longest chapter treats New Orleans’ attempt to cultivate a biotechnology industry out of its strengths in medical research. As narrated in this thesis, biotechnology and biosciences initiatives proceeded slowly before Hurricane Katrina, although the state had enacted several noteworthy initiatives in recent years. Since Katrina, a new political economy focused on recovery and directed by a complex web of federal, state, and local influences is in the process of hashing out several long-term reforms and structural changes in the Bio-Med industries. These changes will undoubtedly impact current attempts to reconstruct the Bio-Med industry in general and, more specifically, to build on pre-Katrina initiatives.

This thesis argues for tempered optimism regarding the potential for biotechnology to serve as a substantial economic base in the New Orleans Region, even before the challenges posed by the current post-disaster environment. However, several proposed reforms in the regional health care system could underlie substantial changes in the role of health care in the regional economy, especially with greater coordination of policy agendas largely fragmented

between industries and scales of governance. Ultimately, health care industrial and occupational strategies may provide a more realistic source of regional economic growth, potentially generating wide-ranging benefits for workers at a diverse range of skill levels.

The Bio-Med industry is, by nature, interdisciplinary. It encompasses university “biosciences” research, entrepreneurial commercialization of high-tech research (“biotechnology”), and the delivery of health services (the health care industry). As such, this thesis has attempted to paint a holistic picture by remaining conscious of the contextual differences among the various fields involved. In addition, policies and plans generated on a variety of scales of governance shape the Bio-Med industries in New Orleans. The account presented here focuses on the region as the unit of analysis but also considers state-level policies as they pertain to New Orleans. Of necessity, the research draws from a variety of sources. Most descriptions of Bio-Med industries and strategies are derived from secondary sources and government documents. Media publications, attendance at public meetings, and information and conversations stemming from the author’s personal (if relatively brief) employment in the field of public health have provided additional sources.

Defining the Bio-Med Industry

Fostering the Bio-Med sector has long served as a goal for New Orleans’ universities, hospitals, economic development professionals, and government. Likewise, in the uncertain post-Katrina landscape, this sector remains explicitly targeted for growth efforts: “The devastation of the Bio-Med base in the New Orleans metro area threatens to kill the goose that lays the golden egg” (BNOB 2005, 45). But what sort of economic activity constitutes this Bio-

Med sector? In other words, to examine the existing and prospective linkages and functions encompassed within the Bio-Med sector, the term “biomedical” first must be defined, along with various related categories like biotechnology, health care, health services, medical devices and pharmaceutical manufacturing, and life sciences research and development. This section considers definitions to the “Bio-med” base articulated in strategic documents for New Orleans and compares these terms with standard industry definitions among technical and academic analyses.

The Bring New Orleans Back Commission (BNOB), a mayoral group that created the highest-profile initial local policy framework after Katrina, specifically treats the “Bio-Med” industry in its economic development plan. The authors of this plan employ the abbreviated term Bio-Med simultaneously as inclusive of several medical-related activities and as synonymous with the health care industry: “This plan covers the broadly classified ‘Bio-Med’ or health care industry which includes five categories under the US Census Bureau North American Industry Classification (NAICS) codes: health care services, health care insurance, life sciences R&D, medical devices and pharmaceuticals” (BNOB 2006, 31). This definition echoes pre-Katrina economic development language. Specifically, in 1991, the state legislature created the New Orleans *Biomedical* Research and Development Park (BRDP), an organizational unit designed to foster the potential of the downtown medical cluster as an economic development district. As an organizational unit, this district’s membership and geographical boundaries essentially mirror those of the New Orleans Medical Complex (NOrMC), a non-profit organization whose mission is to enhance the image and development of the regional medical center located in the Park.

From these labels, it may be concluded that, in New Orleans, the term “biomedical” (or “Bio-Med”) has taken on an inclusive and often nebulous meaning as a targeted growth sector

for at least the last 15 years. Likewise, for the purposes of this thesis, the term Bio-Med will refer to an inclusive grouping of related activities as listed above. However, breaking down this broad category is necessary to disentangle the relationship between the bifurcated social roles of the Bio-Med industry, which provides both an *economic development* engine and an essential *health care* infrastructure. The respective policy priorities and planning competencies involved with supporting each of these roles fundamentally differ. For example, while a health care plan might point to a nurses training program as enhancing capacity and quality in the health care delivery system, an economic development plan might cite the same program as a workforce investment. Obviously, these goals can and frequently do intersect very closely, but their conflated representation has marked New Orleans' approach with a measure of vagueness that serves as a suitable entry point to critical analysis.

This thesis will examine how health care and economic development policy priorities intersect and diverge in the post-Katrina landscape. First, however, an exploration of the specific components of the Bio-Med sector, particularly in light of the academic and professional literature's definition of these categories, informs analytical assumptions regarding the industry as an economic development project. Included within the relatively broad conception of Bio-Med activity in New Orleans, biotechnology stands out as a burgeoning industrial category, apart from the older but related functions of hospitals and universities. Generally, biotechnology may be considered emblematic of the "new economy," in that the industry has come of age in the past 20 years, depends critically on knowledge as opposed to natural resources, and employs a highly skilled workforce (Fitzgerald 2006, 114-115). Unmatched for research intensiveness, the U.S. biotechnology industry spends over \$9 billion in R&D annually (Fitzgerald and Leigh 2002, 53).

Cortright and Mayer (2002, 37-39) discuss at length how the biotechnology industry is defined by itself and by the academics who study it. Table 1 reports Cortright and Mayer's work on assembling industry definitions, along with selected other relevant categories put forth in New Orleans-specific policies documents. While neither old Standard Industrial Classification codes (SIC) nor the new North American Industrial Classification System (NAICS) neatly categorize the biotechnology industry, the Biotechnology Industry Organization and Ernst and Young, who maintain two of the most widely recognized counts of biotechnology firms, generally define "biotechnology" as "the application of biological knowledge and techniques to develop products and services" (Cortright and Mayer 2002, 37). The "biotechnology industry," then, includes firms established to develop this knowledge and to exploit it commercially (6). Mainly, this field utilizes molecular, cellular, and genetic processes that can be applied to a wide range of activities, including agriculture and manufacturing. In the majority of cases, though, biotechnology applications involve medicine and health. While some other industry groups and academic observers differentiate between biotechnology and pharmaceutical production and manufacturing, their definitions regarding what constitutes biotech-related activity remain broadly congruent (38). As listed above, according to the categories explicitly situated within the Bio-Med sector by the BNOB plan, biotechnology firms most closely fall under "life sciences R&D," with the important distinction that biotech workers create knowledge for entrepreneurial commercial development (or "applied" research) in contrast with the academic research carried out at a university (or "basic" research).

Fitzgerald relates biotechnology to a broad industrial grouping that includes manufacturers of pharmaceuticals and medical devices ("biomanufacturing"), all of which otherwise have been combined into a "biopharmaceutical" category of industries (Fitzgerald

Table 1. Selected Biosciences, Biotechnology, and Life Sciences Definitions

	<i>Term</i>	<i>Source</i>	<i>Definition</i>
Industry Definitions	Biotechnology*	Biotechnology Industry Organization, Ernst and Young	The application of biological knowledge and techniques to develop products and services
	Biotechnology*	Institute for Biotechnology Information	Firms founded to use new technologies as the basis of the R&D or manufacturing efforts (differentiates between pharmaceutical and biotechnology firms)
	Biotechnology *	Pricewaterhouse Coopers Moneytree	Developers of technology promoting drug development, disease treatment, and a deeper understanding of living organisms, including biochemicals, cell therapy, genetic engineering systems, drug delivery, and pharmaceuticals (treats medical devices, health care services, and medical information systems as separate industries)
	Biotechnology*	Standard and Poor's 2000	No specific definition (treats pharmaceutical firms separately)
	Bio-pharmaceutical	Milken Institute 2004	No specific definition (includes pharmaceutical and medical device manufacturing and biotechnology)
Academic Definitions	Biotechnology*	Goetz and Morgan 1995	Any technique that uses living organisms or parts of organisms to make/modify products, improve plants or animals, or develop microorganisms for specific use
	Biotechnology*	Hall and Bagchi-Sen 2001	Products and Processes for the diagnosis, treatment, and cure of human disease, as well as the development of genetically customized animals, plants, and food
	Biotechnology*	Paugh and LaFrance 1997	A set of techniques that use organisms or their cellular, subcellular, or molecular components to make products or modify plants, animals, and micro-organisms to carry desired traits
	Biotechnology*	Gray and Parker 1998	No definition (distinguishes between biotechnology and pharmaceuticals)
	Bio-manufacturing	Fitzgerald 2006	The portion of the biotechnology industry engaged specifically in manufacturing processes (distinguishes between biotech, pharmaceuticals, and medical device manufacturing)

Table 1. Continued

	<i>Term</i>	<i>Source</i>	<i>Definition</i>
New Orleans Policy Definitions	Bio-Med or health care industry	Bring New Orleans Back Commission: Economic Redevelopment Plan 2006	No specific definitions (encompasses health care services, health care insurance, life sciences R&D, medical devices, and pharmaceutical; pharmaceuticals includes the biotechnology industry)
	Biotechnology	Bring New Orleans Back Commission: Biosciences Workgroup 2005	The use of cellular and molecular processes to solve problems or make products, and biotechnology firms use cells and biological molecules for applications in medicine, agriculture, and environmental management (differentiates between biotechnology and pharmaceutical companies, contract research organizations, and equipment manufacturers)
	Life Sciences	Bring New Orleans Back Commission: Biosciences Workgroup 2005	Life sciences firms include those that design and produce medical devices and instruments and pharmaceutical companies, and in some cases may include medical labs, hospitals, and medical centers
	Biosciences	Bring New Orleans Back Commission: Biosciences Workgroup 2005	Incorporates life sciences and biotechnology, as well as agricultural chemicals and research and testing

SOURCES: Cortright and Mayer 2002(*), BRDP 2002, BNOB Biosciences Workgroup 2005, BNOB 2006, Milken Institute 2004, Fitzgerald 2006.

2006, 114; *cf.* Milken Institute 2004). Relatively recently, traditional pharmaceutical manufacturers have explored linkages with newer, smaller, and more entrepreneurial biotech firms. Indeed, many biotech and biomanufacturing firms share knowledge, access to capital, support services, and amenities, reinforcing a widely observed tendency for such firms to concentrate spatially. In 2003, the biotech industry employed 191,000 people in 1,457 companies nationally in relatively high-wage, high-value jobs (Fitzgerald 2006, 114). Given the high rate of expected growth in these industries, regions with a strong biotech industrial cluster are well positioned to attract and to retain well paying jobs as the industry continues to mature. Consequently, nearly every state in the union counts biotechnology as an industry targeted for economic development.

While some consensus exists regarding the industry's definition of biotechnology, the way in which biotechnology is defined on the state and local level often varies from place to place. In almost all cases where states or localities have attempted to examine biotechnology-related activity, the definition of biotechnology is tailored to local perceptions (Cortright and Mayer 2002, 39). Almost all of these definitions include biotechnology as defined above as well as other activities under a wide array of other terms, including "biosciences," "life sciences," "biomedical sciences," and "health care technology" (39). On the one hand, most of these studies exist primarily to market the locality as the site of a substantial cluster of biotech and biotech-related activity and, as such, may be prone to inflationary definitions. On the other hand, to some extent, the nature of relationships between actors in a given cluster probably varies from site to site.¹

¹ To illustrate, Walcott, writing separately on the Atlanta life-science (1999) industry and the San Diego bioscience industry (2002) uses a different set of SIC codes to describe employment for each site.

In New Orleans, several terms have been used. For instance, the recent BNOB plan uses the terms “Bio-Med” and “health care industry” interchangeably and mainly addresses the status of the downtown “health sciences district,” otherwise known as the “downtown medical complex” (BNOB 2006, 29). Notwithstanding the use of the term in New Orleans, “biomedical” usually is defined more restrictively as the use of life sciences for medical applications. In this sense, a biotechnology firm may be engaged in biomedical activity by attempting to commercialize a life science-based technology for medical applications as opposed to, for example, food processing applications. However, in New Orleans, Bio-Med inclusively refers to biosciences (academic research, private biotech firms, etc.) *and* the health care industry (health services, insurance, etc.). Despite relying on a similar set of institutions, these sub-categories structurally diverge in terms of industrial organization, labor, and production processes. Health services and biosciences/biotechnology may be described more accurately as separate but related economic activities, operating at opposite ends of a long and exceptionally complex medical production chain. The BNOB plan reports that the Bio-Med industry supported approximately 12 percent of the area’s employment in 2004, second only to tourism and first in both revenue (\$8.7 billion) and payroll (\$2.7 billion); but health care services account for the vast majority – 95 percent – of Bio-Med employment. While New Orleans-Area institutions employ many workers in biosciences and medicine-related fields, firms attempting to commercialize biomedical technologies employ very few. Thus, as used in the BNOB plan, the Bio-Med term’s inclusiveness may be interpreted as symptomatic of the tendency to employ inflationary biotechnology definitions on the local level. The next chapter reviews the nature of high-technology regions, with particular attention to the localized aspects of biotechnology commercialization.

II. Literature Review

A General Review of Economic Geographies of Innovative Environments

From the definitions above, life sciences and biotechnology epitomize the knowledge economy, in contrast with more traditional industries. A large body of research within economic geography, industrial innovation, and economic development addresses this phenomenon and highlights two seemingly paradoxical processes at work (Gertler and Levitte 2005). On one hand, the emphasis on knowledge, as a relatively mobile factor of production, to an extent, has freed high-technology industries of certain geographical constraints such as hard infrastructure, natural resources, and large pools of relatively low-skilled labor. On the other hand, the most knowledge-intensive industries, including biotechnology, show a high degree of geographical concentration, reflecting the persistence of a locational pull in the innovation process. This section further explores this dynamic through a critical review of literature on the economic geography of innovation, particularly in relation to the biotechnology and life sciences industries, and examines how these theories are put into practice within the field of economic development.

The process of technological change provides an illustrative starting point, albeit one for which a substantial body of literature admittedly has only produced partial understanding. The traditional “linear model” of innovation continues to underlie most policy thinking about technology and economic development and also serves as a theory of knowledge production (Malecki 1991, 114; see Steinmueller 1994 for a review). Briefly, the linear model consists of a sequential process where “basic” research produces findings, which are refined through “applied” research, then tested during the “development” process, and finally commercialized

through production, diffusion, and marketing. Along the way, the outputs of each stage act as inputs for the next stage. The lesson then follows that policy-makers should quite simply strive for an appropriate balance between basic research and applied research and that development will follow naturally.

However, while the linear model continues to inform explanations of the link between basic research, innovation, and economic development, many researchers have highlighted the shortcomings of such a sterile, unidirectional, and overly simplistic process (Steinmueller 1994; Malecki 1991, 115). In reality, innovation proceeds in a much more disorderly fashion than purported by the linear model and varies widely by product and industry. Numerous feedbacks exist both internally and externally to the model's discrete stages. For example, the diffusion of scientific knowledge may filter through institutional pathways to determine the goals, methods, productivity, or funding sources of basic research. In other cases, inefficiencies or obstacles in the development stage may force adjustments upstream in the applied research phase, challenging the concept of a unidirectional route of transfer from science to technology. Moreover, while the linear model links science with social gains, this innovation and development process is situated geographically and socially in ways that complicate the model's conceptual simplicity.

More sensitive models of economic growth and development have increasingly directed an analysis of local factors of economic growth, that is, the extent to which agglomeration reflects a spatially embedded system of innovation. Since the early 1980s, study has isolated the region in particular as a site of "untraded interdependencies" for an industrialized world consisting of "Post-Fordist," "flexibly specialized," or "learning-based" firms (Storper 1995). To be sure, the study of the geographical concentration of economic activity is, by no means, a

new topic. In fact, Weber's theory of the agglomeration of urban economic activity, Marshall's industrial districts, and Schumpeter's original observation of the clustering effect have continued to lay the theoretical basis – or at least the inspiration – for the work of many industrial economists and economic geographers throughout the Twentieth Century. Many of these researchers have tried to offer greater empirical understanding to Marshall's whimsy that "knowledge is in the air;" but while studies have documented the importance of local networks and social interaction, the empirical mechanisms of knowledge spillovers and externalities have not been made explicit (Feldman 2000, 389; Storper 1995). Descriptive analyses of local or regional innovation and development processes have produced various typologies and vocabularies – many of which are not necessarily mutually exclusive – that differ by the specific focus of analysis and to a lesser extent by industry, by regionally specific geographical or social characteristics, or by the individual researcher's academic tradition and inclination.

To illustrate the diversity of approaches, Marceau (1994) identifies three such lenses for analysis and policy formation in national economic systems, named for their central descriptive metaphors: clusters, chains, and complexes. The clustering of innovative firms, first recognized by Schumpeter, stresses interactions between and within related industries, usually highlighting the process of geographic concentration at the local, regional, or national level. Many contemporary cluster analyses follow Michael Porter's influential brand of study, which stresses competition between firms and only incidentally mentions geographic concentration and productivity gains from locally driven cooperation; others follow the tradition of Marshall's study of industrial districts and foreground geographical concentration and cooperation between firms (Marceau 1994, 7). In the cluster metaphor, firms relate through web-like networks of interaction. The "chains" model, in contrast, stresses firm activities as linkages along a supply

chain, or “input-output” system, such that innovations at any level could have consequences upstream or downstream in the production process. Finally, the “complexes” metaphor seeks a more holistic account of cooperation between four major groups of actors: producers (firms), public-sector research organizations, users (consumers or other firms), and regulators (governments and mediating organizations of all levels) (9). This approach considers government in an active role in innovation policy and research funding, and applies especially well to innovative activities with a public welfare component, like health care (10). Ultimately, while none of these lenses offers a total view of the economy, each is a necessary supplement to cruder neo-classical views on industrial competitiveness.

These national systems have regional and local analogs, where more individualized spatial relationships take precedence over national- and international-level trade and regulatory structures. Theoretical work has highlighted the salience of such concepts as an “innovative milieu” acting as essential infrastructure for innovation, and the most widely cited regional archetypes include Silicon Valley in California, Route 128 in Boston, Baden-Wurttemberg in Southern Germany, and Emilia-Romagna in Northern Italy, among others, where small- or medium-sized firms have played an integral role in regional economic success (Cooke and Morgan 1994, 25). This literature stresses collaboration between firms (often in the form of “untraded interdependencies”), knowledge spillovers (mainly through the often nebulous concept of “networks”), and the importance of a “soft infrastructure” of institutional support for business innovation from the public sector, the private sector, or public-private partnerships (Storper 1995; Cooke and Morgan 1994, 31).

The literature on the socio-political structures of innovation and economic growth seemingly varies almost as much as national, regional, and local systems of innovation

themselves. Likewise, there is some variation across attempts to list the necessary “ingredients” of an innovative, entrepreneurial, or “creative” region. Malecki (1991, 330-334) reviews several such lists, most of which include some combination of the following:

- venture capital availability,
- the presence of experienced entrepreneurs and a cultural atmosphere for entrepreneurialism,
- a technically skilled labor force,
- accessibility to suppliers and new markets,
- favorable government policies and regulations,
- attractive living conditions,
- availability of land,
- adequate transportation and other hard infrastructures,
- proximity to universities, and
- supportive institutions.

Of course, several of these “ingredients” are common to most, if not all, large urban areas. Other analyses have added geographical characteristics of agglomerations, including less quantifiable factors like the level of instability and uncertainty in the local economy and the diversification of economic activity. Finally, quality of life factors increasingly are seen as necessary for attracting and maintaining the more mobile ingredients of an entrepreneurial region, such as knowledge and skilled labor, to feed the more locally embedded qualities, such as the entrepreneurial climate and institutional support. Florida’s (2002) writings on the “creative class,” perhaps the most famous statement on the link between quality and diversity of life styles and economic growth, have achieved a rare level of acceptance among mainstream policymakers in the United States. On the whole, however, while these lists may provide useful analytical taxonomies, entrepreneurial environments are too complex to reduce to a few simple variables for manipulation through policy, especially when accounting for regional variation (Malecki 1991, 334). Despite a persistent lack of empirical clarity, the mechanisms of regional innovative milieus are site-specific and path dependant, and often determined by national and international

(i.e., non-local) determinants. Somewhat paradoxically, even as local and regional factors have increasingly been subjected to study, contemporary globalized trade and finance networks have left technology systems vulnerable to increasingly footloose factors of knowledge and capital, counterbalancing the importance of an embedded milieu (Gertler and Levitte 2005).

As noted above, a diversity of scholarship on regional innovation and entrepreneurialism has analyzed the phenomenon of geographically concentrated economic activities. Lately, this academic knowledge filters to policymakers primarily through a clusters approach and most commonly through Michael Porter's particular "brand," as popularized by his influential research and his leadership of the Institute for Strategy and Competitiveness. Indeed, since the 1990s, Porter's work has become *de rigueur* in the rhetoric of mainstream economic development, particularly where economic theory underlies policy decisions that direct the investment of public and private funds. In policy documents concerning New Orleans' life sciences industry, Porter's theory is the only theoretical work cited; therefore, a closer examination of his model of clusters and competitive advantage is merited. Porter defines a cluster as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities" (Porter 2000, 254). The geographical scope of such clusters may range from a single city to a group of neighboring countries, depending on the strength of "spillovers" among a host of related firms, infrastructure providers, training and technical support institutions, regulatory agencies, and trade associations (254-255). In Porter's dynamic formulation, clusters influence competitive advantage in three broad ways: by increasing the static productivity of constituent firms or industries (e.g., through access to specialized inputs and labor, access to information and knowledge, complementarities, access to institutions and public goods, and through incentives and performance measurement), by

increasing a firm's capacity for innovation and thus for productivity growth, and finally by stimulating new business formation that supports innovation and expands the cluster (Porter 2000, 259). A "diamond" metaphor, now shorthand for Porter's model, stresses interactions between four sources of local competitive advantage: factor (input) conditions, demand conditions, related and supporting industries, and the context for firm strategy and rivalry (Porter 1998, 166-167). Porter has liberally applied this model, ranging from national systems of innovation (see *The Competitive Advantage of Nations*, 1990) to the potential for inner city redevelopment (see "New Strategies for Inner City Economic Development," 1997).

Despite a long international tradition of study and policy based around the concept of agglomeration's role in innovation and economic growth, Porter's cluster model has transformed into a mantra for economic development, often carrying with it the enticement of novelty, such that Glasmeier (2000, 562) identifies Porter's influence as a "Fourth Wave" of economic development practice, even supplanting the third phase's primary emphasis on public-private partnerships. Many of these ideas concerning geographical influences on innovation and growth, of course, are as old as the fields of economics and economic geography themselves. Newlands (2003), for example, identifies five different theoretical traditions drawn upon by contemporary literature: standard agglomeration theory (from Marshall onwards); transaction costs (the "California School"); flexible specialization, trust, and untraded interdependencies; innovative milieu (the GREMI Group); and institutional and evolutionary economics. Benneworth and Henry (2003) add Porter to this list – notwithstanding the disputed originality of his contributions – since his research has so frequently appeared as a novel touchstone for public policy, ironically even as his work downplays active participation by the public sector. While Porter's model likely owes some of its popularity to its coincidental appearance and theoretical parallels with

neo-liberal deregulation processes, some of the approach's novelty derives from the conceptual blending of the cluster model. That is, while economic geographers generally view the cluster as horizontally integrated innovation network, or as a system of non-traded interdependencies like trust, geographical economists embark on the assumption that clusters represent an agglomeration of economic activity, enhancing local competitive advantage in a liberal growth model. In fact, this difference has caused some antagonism between opposing sides of the debate (Benneworth *et al.* 2003, 515). Porter, however, stresses the perspective of the private sector and its competitive logic, perhaps an artifact of his strategic management background and his earlier work on international competitiveness. Additionally, Porter's diamond model is exceptionally malleable both in its scale, having been applied to analyses of neighborhoods and international systems of production alike, and in its terminology, into which almost any economic activity could fit as evidence of a cluster.

To some extent, policymakers have applied Porter's model to legitimate traditional sectoral strategies. With empirical definitions of clusters, their interior workings, and their geographical scales and boundaries still unsettled, the concept lends itself to industrial targeting and locality promotion – the presence of nearly any firm could be molded into a potential or existing competitive advantage in the cluster model. At the very least, cluster policies in practice include a variety of different and, in many cases, imprecisely defined approaches that are largely, if not primarily, determined through the political process.

Glameier (2000) highlights several problems with the recent renewed interest in clusters. Perhaps the most serious shortcoming is its proponent's failure to account for the importance of economic diversity in an innovative region. This boils down to two different types of economic agglomeration on which Porter's model lacks clarity: "localization," the clustering of related

firms for benefits derived from proximity, shared labor pools, etc., and “urbanization,” the mutual gains to productivity arising from a broad mix of proximally located economic activities across industries and sectors. Glasmeier (2000, 566) cites a notable body of research to contend that innovation and economic growth derive unambiguously from a locale’s urbanization and only in limited cases from a sectorally narrower industrial specialization. In other words, some localities might simply lack the critical economic mass and diversity necessary to support a self-reinforcing innovative cluster with wide-ranging economic impacts (Malecki 1991, 313-314).

In addition to concerns with the shortcomings of Porter’s model, some have criticized the centrality of the private sector in his discourse. In particular, his popular article “New Strategies for Inner City Economic Development” (1997) has been criticized as the newest example of “gilding the ghetto,” as if simply improving neighborhood business climates and decreasing the role of the public sector will expose latent competitive advantage and help to alleviate the structural causes of persistent poverty. Harrison and Glasmeier (1997), Blakely and Small (1997), and Fainstein and Gray (1997) have convincingly responded that the private sector alone, acting through a cluster model, will not alleviate urban poverty and that the public sector must play a more active role in theory and strategy. Still others have criticized the very validity of the cluster approach, mainly citing its misappropriation in practice. To some extent, the academic resurgence of the regional cluster, as epitomized by the popularity of Porter’s particular brand, has merely translated into rhetoric for locality promotion and a new patina for older industrial retention and recruitment policies in economic development practice. Despite a lack of clarity regarding the geographic scale, interior workings, and role of policy in industrial clusters and an abundance of evidence to validate the importance of economic diversity and path dependence, policymakers have accepted the assumption that technology-based economic development is

largely determined by a vague clustering effect. Consequently, economic development professionals and policymakers have routinely sought to promote the indigenous potential of their constituent regions to produce or to adapt innovations to commercial uses and have shaped the public sector's role into one of a catalyst or facilitator in attracting, creating, and retaining high technology firms. In this sense, the attractiveness of high-tech industries and the popularity of Porter's pliable, private-sector-centric model have converged to substantiate a trendy rhetoric for sectoral strategies. Blakely and Nishikawa (1992, 241) write,

In their attempts to formulate new roles and missions, state government leaders have evoked attractive images and metaphors based on the experiences of Silicon Valley and Boston's Route 128. The language used in policy discourse often blurs the distinction between description and prescription. Policy concepts, embedded in high-technology success stories, are repeated and diffused through professional networks and the popular media.

Yet, despite the attractiveness and adaptability of the image of a high-tech cluster, a long tradition of cluster studies, contrary to the optimistic possibilism of recent iterations (i.e., Porter), suggests that the capacity for indigenous systems to attain innovation-led economic growth from a narrow sectoral specialization is unlikely for the vast majority of regions and localities. Martin and Sunley (2003), in particular, see little more than a powerful and often poorly misappropriated "brand" in the concept of clusters, for which Porter is a gatekeeper, eclipsing the work of other economic geographers and established theories in the policy arena. Benneworth and Henry (2003) answer this criticism by highlighting the diversity of cluster studies beyond Porter's influence and the potential for interaction between diverse, even unsettled theoretical positions. In particular, they draw on Barnes's description of the recent phase of "hermeneutic" economic geography that is open-ended, reflexive, catholic in its theoretical sources, and self-consciously perspectival and partial (Barnes 2001, 561). Given some rigor with respect to recognizing the multiplicity of theoretical traditions, "the value added of the clusters approach

(drawing on hermeneutic theorizing) lies in, first, allowing for and explicitly promoting these theoretical conversations and, secondly, the potential this may afford in which multiple explanations can interact conceptually to provide a richer understanding of the situation than permitted by theoretically monistic approaches” (Benneworth and Henry 2003, 1018). It is from this perspective that the following account of biotechnology in New Orleans brings a variety of sources to bear on the Bio-Med “cluster” as the unit of analysis – even if this use of the term is open to interpretation. The analysis is somewhat purposefully open-ended and complex, as is the situation itself, determined by factors relating to the regional health care system as well as to local milieu. Before considering New Orleans, however, a review of biotechnology experiences in other regions offers a basis for comparison.

Comparative Case Studies of Bioscience Clusters

Preceding sections have floated working definitions and descriptions of the biotechnology industry and have discussed broad trends in research on – and strategic implementations of – technology-driven local systems of economic development. This section combines these themes into a review of existing case studies for biotechnology clusters, with the aim to draw out industry-specific determinants of successful development. To an extent, this attempt draws more heavily from economic development literature, which views biotechnology in particular as an increasingly enticing target for local growth efforts, as opposed to economic geography, which often – perhaps to a fault – lumps biotechnology together with other knowledge-intensive activities in a more generic model of flexible-specialization.² Of course,

² This claim is not without exception. Walcott’s (1999; 2002) work, in particular, exemplifies an attempt to bridge the divide between theory-oriented economic geographers observing

these perspectives are related: the biotechnology industry is maturing, and as a course in its “life-cycle,” its expansion and codification of products and processes will rearrange the diffusion of benefits to participating localities. In this sense, biotechnology appears to have the characteristic of a new “core technology,” with the potential to underpin a new paradigm of development (Gertler and Levitte 2005); and state and local policymakers view increasing or maintaining participation in this process as an attractive possibility, even while literature specific to the locational needs of biotechnology firms remains insufficient (Walcott 1999, 48).

In a broad snapshot of the biotechnology industry, Cortright and Mayer (2002, 3) note a high degree of concentration: 9 of the nation’s 51 largest metropolitan areas house three quarters of the largest biotech firms, and only four of these account for the majority of recent growth (Fitzgerald 2006, 115). While NIH funding for basic research and biotech patents has dispersed in recent decades, the private financing system has become increasingly concentrated within the top tier of biotech regions, which “account for 88 percent of all venture capital for biopharmaceuticals, 92 percent of the most active biotechnology venture capital firms, and 96 percent of the dollar value of research alliances with pharmaceutical firms” (Cortright and Mayer 2002, 33-34). Further below in the biotechnology hierarchy, 28 metropolitan areas, including New Orleans, contain some significant biotechnology research and commercialization but at levels well below the top-heavy average of the entire group. The authors refer to these areas as “median” metropolitan areas, and the most intense competition to emerge as a nascent biotechnology center is most likely to take place here.

The major biotechnology “core” areas have several features in common, which may be interpreted as likely preconditions for successful development. Broadly, these biotech centers

biotechnology development after-the-fact and practice-oriented economic development scholars attempting to build best practices for influencing biotechnology development *ex ante*.

share two key characteristics of a strong research capacity and the ability to convert research into successful commercial activity through access to capital and a developed entrepreneurial climate (Cortright and Mayer 2002, 3). Still, some variation exists within the top tier. While carving the mold for American high-technology development in general, Boston and San Francisco have led the biotechnology industry since its inception in the 1970s. The Philadelphia and New York metropolitan areas have historically housed headquarters for the nations largest pharmaceutical manufacturers. The Washington-Baltimore area contains a significant biomedical research establishment, including the National Institutes of Health (NIH). The Los Angeles area houses the nation's largest biotech firm, Amgen. Newer entrants San Diego, Seattle, and Raleigh-Durham have built upon the local assets of a well recognized, well-funded research establishment and a climate favorable to start-up firms. These three newcomer regions, together with Boston and San Francisco, account for the vast majority of growth in new biotech firms (Cortright and Mayer 2002, 3). As a whole, these exemplary areas share not only proximity to pre-commercial research institutions like universities but also the financial and entrepreneurial conditions required to sustain the large level of private investment necessary to adapt basic research into marketable products.

The top tier group expectedly accounts for the focus of the majority of existing biotech literature, and several relevant case studies highlight certain aspects of biotechnology-based development in specific regions or localities. Walcott (2002) uses San Diego's bioscience cluster to illustrate the dynamics underlying the construction of an innovative environment.³ Her interviews with local industry professionals reveal five key factors underlying regional success:

³ In reference to the earlier discussion of unfixed terminology in life sciences-related industries, Walcott focuses on biopharmaceutical and medical device firms, which she terms "bioscience" firms, as opposed to, for example, bioagricultural firms (2002, 99).

access to an outstanding research university, advocacy leadership, risk financing, and entrepreneurial culture, and appropriate real estate for each stage in a firm's growth, preferably in proximity to related university research activity. Her narrative of San Diego's emergence as "Bioscience Beach" stresses the strong interpersonal component of knowledge networks as well as the importance of a role model firm, Hybritech, originally a tech-transfer project from the University of California, San Diego, that capitalized on a broad convergence between the pharmaceutical and biotechnology industries during the 80s. In an excellent example of the development of a local entrepreneurial milieu, wealthy Hybritech employees helped to spin off numerous additional companies, forming a core of local venture capitalist "angels" eager to stay in an area attractive for both life-style and professional reasons through self-reinforcing cluster activities (105). Rather than relying on firms and labor from outside, San Diego's bioscience cluster was able to generate its own skilled labor and knowledge flows from local universities and research institutions like Scripps Research Institute, helping to allow the creation of smaller, locally embedded enterprises instead of attracting established firms from outside. Active advocacy and leadership, most notably the often-emulated industrial organization CONNECT, also played a key role, both through nurturing new and existing firms and through lobbying governments at all levels.

Huag and Ness (1993) investigate industrial location decisions for biotech firms by surveying industry executives in the Seattle area. They conclude that R&D and manufacturing facility locations emphasize founder preferences, proximity to university or company facilities, labor agglomeration economies, and local infrastructure, with manufacturing facilities particularly displaying a greater concern for land and labor costs. Local regulations and taxes add additional wrinkles to the complex importance of proximity for R&D and manufacturing

activities. Factors accounting for Seattle's success include strong federal research funding at the University of Washington, a local entrepreneurial climate to actively nurture small enterprises and spin-off firms, an *a priori* concentration of numerous other high-tech firms (e.g., Microsoft, Boeing) to condition access to knowledge and labor, and the presence of several successful "role model" biotech firms. Interestingly, Huag and Ness note that the Seattle cluster, like most other biotech centers, developed without significantly organized and comprehensive biotech-specific efforts on the part of university or state agencies (399). Nonetheless, they recommend that, to implement viable strategies for biotech development, state and local governments should increase the availability of venture capital funding, support scientific and technical education programs, assist in obtaining federal university research funding, maintain consistency in regulatory policies, develop efficient and effective technology transfer systems, and, possibly, establish incubator or scientific support facilities. The authors also discount the effectiveness of incentives, subsidies, tax concessions, and low-interest loans for attracting new industry (399).

Feldman and Francis's (2003) description of the rise of Maryland's biotech cluster emphasizes the role of public investment and existing strengths in life sciences research and talent around the Capitol Region as enabling factors for entrepreneurialism in the innovative milieu. Proximity to universities (Johns Hopkins, University of Maryland) and government departments (the NIH and FDA) and their attendant research laboratories aid the cluster by anchoring personnel movements, technology licensing, and collaborative research agreements (770-771). The state has kept pace with a national trend by constructing 11 business incubators, some including crucial wet-lab space for biotech as well as firm consulting, ancillary business services, and infrastructure (773). Like other regions, Maryland has an active non-profit industry organization, MdBio, to aid in funding and cluster promotion (773). Maryland's biotech

emergence is notable because public-sector employment has historically dominated the Capitol Area in an economic system generally not considered exceptionally conducive to innovative or entrepreneurial activity. Feldman and Francis describe the transformation as a result of a three-stage process: federal-level economic restructuring and policy changes to favor biotechnology enterprises,⁴ increased local entrepreneurial competency for start-ups in a region lacking a more traditional large corporation, and a fully functioning entrepreneurial environment within an innovative and adaptable industrial cluster. Beyond state- and local-level cluster policy, this particular narrative is deeply tied to exogenous forces and to the unique characteristics of the Capitol Region, mainly government laboratories and universities and their respective pools of skilled labor. In Feldman and Francis' estimation, cluster policies such as incubators, incentives, and funding initiatives lagged behind rather than led entrepreneurial engagement with an existing concentration of biosciences-related activity. Overall, the Maryland experience provides a significant challenge to a one-size-fits-all policy for building an innovative cluster without a strong tradition of entrepreneurialism.

Acs, Herron, and Sapienza (1992) hone in on the financing component of Maryland's biotechnology industry, primarily centered on the Baltimore-Washington Region. Through firm surveys, they find that the majority of Maryland's biotech firms import capital mainly from New York and New England, implying that Maryland's significant biotech cluster lacks the local venture capital networks present in Silicon Valley and Route 128 (381). Despite the Baltimore Area's research and institutional strengths, a gap exists between local venture capital community and the financial needs of early-stage and start-up firms, hindering the effectiveness of other

⁴ In this case, the federal government's role included setting a national research agenda with broad funding distributed through laboratories and grants, and establishing regulations and standards for the industry as a whole (Feldman and Francis 2003, 785). The Capitol Region was particularly well-positioned to take advantage of these changes.

strategic interventions, such as incubators and shared facilities to promote technology-based development.⁵ Gertler and Levitte (2005) offer similar findings for Canadian biotech firms, which they cite as evidence to destabilize the recent literature's emphasis on the importance of local networks of capital and information flows *vis a vis* global networks. These non-local flows may simply reflect biotechnology's maturity as an industry and its need to expand relationships beyond the nursery of a local innovative milieu; but in any case, a successful biotech region likely must be open to inter-regional and even inter-national flows of knowledge and capital.

Even within a given region, there exists a diversity of experiences. Fitzgerald and Leigh (2002) use New Haven's attempt to build a Bioscience Cluster to capitalize on Yale's research strength as an example of technology-led sectoral strategies. Despite being located within the New York region,⁶ the state, the city, and the university were relative latecomers in targeting biotechnology. Part of New Haven's success followed from a change in leadership at Yale in the early 1990s, when the university began to actively sponsor university biomedical programs aimed at creating a cluster that would mutually benefit New Haven's economic development and the university's research agenda (Fitzgerald and Leigh 2002, 54). Along with a state-level adoption of Porter-influenced initiatives, a non-profit oversight corporation, Connecticut United for Research Excellence, Inc. (CURE), facilitates information exchange and communication among Bioscience Cluster members and publicizes and markets the cluster's contributions. CURE has also been successful in lobbying for favorable tax incentives for research and biotech start-ups and for streamlining permits. Meanwhile, the state has provided successful gap capital

⁵ Feldman and Francis' (2003) later study on Maryland, while not focusing discretely on venture capital, mentioned the region's relative lack of seed funding as a continuing weakness when compared with other top biotech clusters.

⁶ New Haven is located within the top-tier New York Region as Cortright and Mayer (2002) define it, following the census New York-Northern New Jersey-Long Island, NY-NJ-CT-PA CMSA.

funds for the fixed costs (e.g., lab and office space) of startups, since venture capitalists are much more likely to finance research and development costs (Fitzgerald and Leigh 2002, 57). The city has taken a facilitator role through marketing, investments aimed at improving quality-of-life, strategic real estate development (including business incubators and brownfield redevelopment), and regulations. Private real estate investors and biotechnology companies have followed with their own investments in laboratory and office space. Fitzgerald and Leigh, however, note a weak link in the New Haven cluster strategy: workforce development at the state and local levels (Fitzgerald and Leigh 2002, 62). While experts predict future labor shortages as demand for biotech labor grows, many of these positions require only community college training rather than college degrees. However, Connecticut has made little effort to offer relevant associate's degree programs, and biotechnology firms remain skeptical that workers with only associate's degrees could fill their positions (Fitzgerald and Leigh 2002, 62). Another criticism addresses distributional issues. High-technology sectoral strategies create mostly high-wage, high-skill jobs and benefit only a narrow range of occupations (Fitzgerald and Leigh 2002, 64). The venture capital, real estate needs, and infrastructural investments of biotech strategies, such as business incubators and lab space, require a particularly high rate of subsidy per directly created job. In a sense, Connecticut's sectoral initiatives have replaced an older corporate-subsidy approach to economic development, where benefits are expected to trickle down through economic multipliers (Fitzgerald and Leigh 2002, 65).

Moving further from the core biotech regions, Walcott (1999) explores spatial aspects of the biomedical industry in and around Atlanta, which remains underdeveloped as an innovative milieu despite the region's steady growth since the 1980s. Her surveys and interviews reveal the primacy of "personal real estate factors" (roughly comparable to quality of life concerns) over

place-based innovation characteristics or inter-firm linkages as priorities for firm location decisions. As such, endogenous agglomeration advantages such as knowledge spillovers are apparent, but their contribution to the broader local accumulation of knowledge is muted (67). Biotech agglomerations thus have paralleled the proliferation of “technoburbs” in the Atlanta region (Fishman 1987) and the restructuring of medical laboratories and hospitals to accommodate the demands of health maintenance organizations (HMOs) (Walcott 1999, 66-67), and have been crucial for attracting skilled technical and management talent. Atlanta certainly offers regional strengths as a growing area with an established presence of a skilled workforce, ample hard infrastructure, and life sciences-related institutions like the CDC.⁷ However, Walcott concludes that no shortage of structural “pull” factors nor a prevalence of less favorable “push” factors hinder development of an innovative milieu; rather, a lack of agency, such as a key networking individual or mediating organization, critically retards the biomedical cluster’s emergence into regional growth engine.

Fitzgerald (2006) focuses on career ladders and workforce development in core biotechnology regions. Tailoring her focus around the more labor-intensive biomanufacturing processes, her review reveals successes in matching community college programs with demand for biotech labor, especially for lab-tech positions requiring only a two-year degree. However, Fitzgerald (2006, 115) warns that only the largest biotech centers are best positioned to capture growth on the manufacturing end, as proximity to R&D and path dependence involved with permitting new plants hedge growth in the years ahead. Furthermore, biotech firms are, by nature, high-risk, high-reward operations. Only about 20 percent of drugs in early trials ever make it to market, and only about 30 percent of these produce profits higher than the cost of

⁷ Interestingly, Coca-Cola was instrumental in luring the CDC to Atlanta (Walcott 1999, 62).

R&D, which in most cases runs into the hundreds of millions of dollars (115). Fitzgerald succinctly and convincingly expresses a case for tempered optimism regarding the potential for biotech growth in marginal areas:

In brief, states that court the biotech industry – job-training programs, tax abatements, venture capital, and other incentives to reduce a new company’s start-up costs – are taking a big risk. And, in most cases, it probably is not a smart one (115).

Even successful biotech strategies, such as business incubators, utilize a high rate of subsidy per directly created job (Fitzgerald and Leigh 2002). Moreover, biotech firms, by nature, seek a flexible approach to maximizing profits through partnerships with universities and especially with large pharmaceutical firms from outside of the region – a complex and footloose interregional economic geography. Most of these small firms have little interest in growing into the size of incumbent biotechnology firms. Consequently, much of the benefit from local policies aimed at improving the entrepreneurial climate, such as business incubators and subsidies, accrues elsewhere, mainly in the top tier of biotechnology regions.

Most successful biotechnology commercialization, perhaps one out of one thousand patented innovations, may require a decade of development (Cortright and Mayer 2002, 4). Moreover, even in established biotechnology centers, the overall size of the biotechnology sector is relatively small when compared with the overall regional economy. For the nine leading biotechnology centers, pharmaceutical manufacturing employment accounts for only 3.5 percent of total manufacturing employment (35). While economic developers in wide range of regions gaze longingly on a biotechnology as an industry poised to explode, the expected aggregate growth realistically will not drive significant local activity in the vast majority of cases.

III. Building a Bio-Med Cluster in New Orleans

The preceding sections have offered standard definitions for biosciences- and biotechnology-related terms, discussions of the geography of innovative regions in general, and comparative case studies of biotechnology-oriented economic development. This section applies these concepts to New Orleans, with the goal of critically assessing the region's attempts to cultivate biotechnology and the various economic, political, and geographic constraints on this possibility. First, a snapshot of New Orleans' Bio-Med industries before Katrina highlights the city's assets and strategies leading up to the massive upheaval of late 2005. Next, a brief summary of various planning efforts since the storm suggests new challenges and opportunities for planning biosciences as an economic development project. This planning process, however, is primarily characterized by a host of other, more immediate considerations in a political system primarily charged with managing several massive recovery and rebuilding projects.

Restructuring the regional health care system, itself the subject of a major planning effort, is only one of these other projects, but its trajectory has critical implications for the biosciences industry, since many of the same educational and research institutions serve as lynchpins of the regional potential for biotechnology competitiveness. The concluding section speculates on the decision-making process as it relates to biosciences and health care in the post-Katrina environment and the implications for economic development policy.

Pre-Katrina Attempts to Capitalize on the University Research Base

Biosciences-related Universities and Institutions

Prior to Katrina, New Orleans' main biosciences strength lay in the value of research conducted at local universities. Awards from the National Institutes of Health (NIH) are generally regarded as a benchmark figure for publicly funded biotech-related research activity, and higher levels generally suggest greater opportunities for commercial ventures and partnerships involving private biotech firms. In 2002, the metro area's \$77.3 million in NIH funding placed the region 48th in the country (BNOB Biosciences Workgroup 2005, 35). According to the BNOB plan (2006, 30), in 2003, federal and private grant funding for New Orleans bioscience institutions exceeded \$180 million and showed substantial growth in recent years. An earlier plan placed the value of research performed at Tulane University Health Sciences Center HSC, Louisiana State University Health Sciences Center (LSUHSC), and the University of New Orleans (UNO) at \$232 million, which includes substantial biomedical initiatives in gene therapy, neuroscience, cancer, ophthalmology, peptides, biology, conservation biology, and assisted reproductive technology (BRDP 2002, 15). In fiscal year 2005, the New Orleans Area accounted for \$129.8 million in awards from the NIH, representing 74 percent of the total amount awarded within the entire state of Louisiana (BNOB Biosciences Workgroup 2005, 11). These high figures generally have kept pace with a national trend toward increasing research funding in the health sciences.

Tulane University and Louisiana State University Health Sciences Center, New Orleans, received the vast majority of NIH research funding, at \$71 million and \$41 million, respectively, in 2005 (BNOB Biosciences Workgroup 2005, 11). The inclusion of other program revenue funds increases these totals to over \$100 million for each institution. Both universities have a

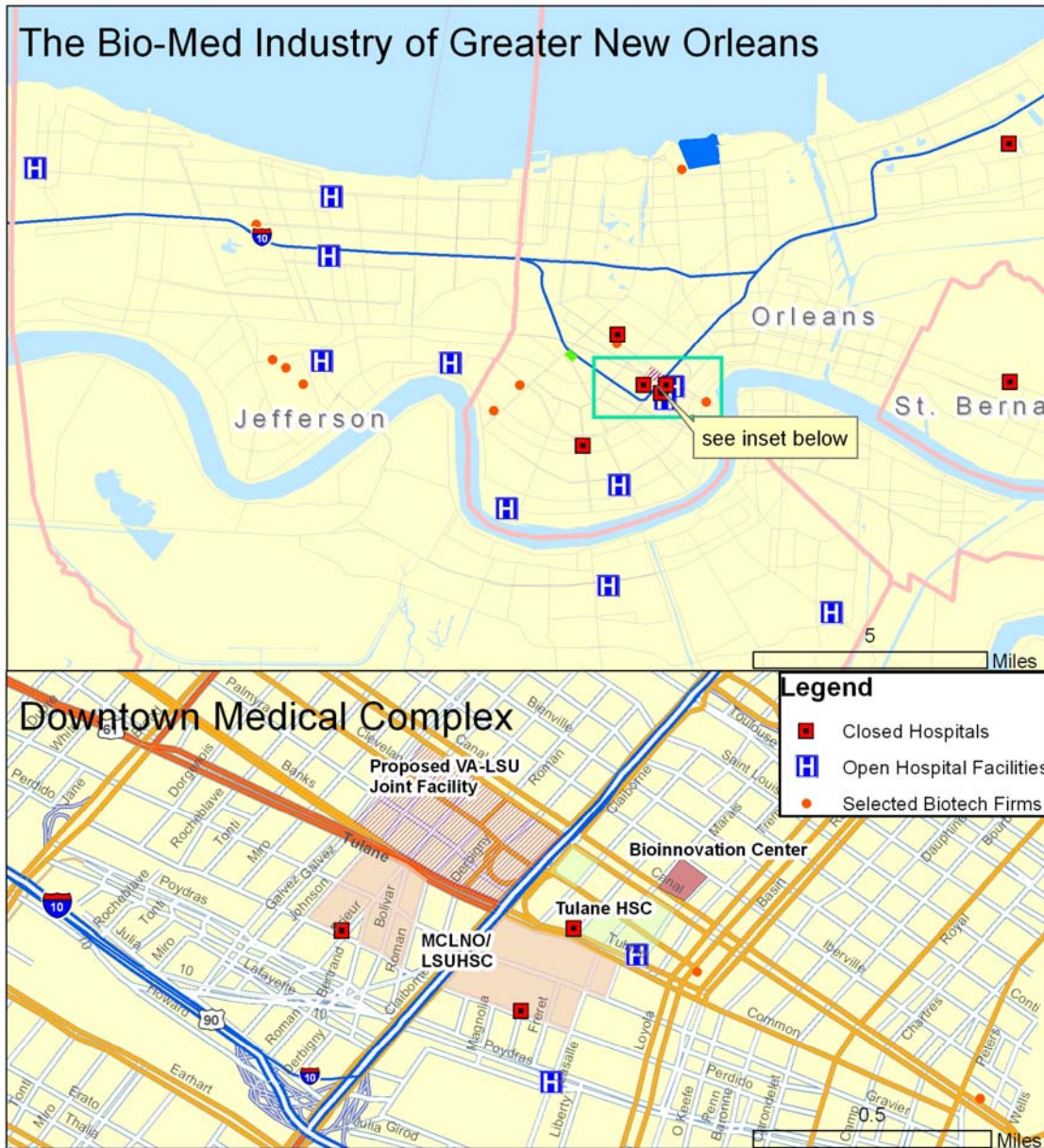
substantial presence in the New Orleans CBD, where various medical educational, research, and clinical facilities operated by each school anchor the downtown medical district (see Figure 1). These facilities are key components of the regional and, when accounting for their role in training Louisiana's health workforce, statewide health care systems. LSUHSC trains 70 percent of the state's health care professionals in a variety of disciplines and manages the state's unique network of eight public hospitals, otherwise known as the Charity System. To promote economic development, to attract faculty with licensing opportunities, and to generate revenue, Tulane entered the intellectual property field in 1985, and LSU organized its own Office of Technology Development in 2000. These offices handle patent applications and licensing for intellectual property generated within the institutions. Both offices have forged successful partnerships and joint ventures with local and national firms, local hospitals, and other research organizations. In FY 2003, Tulane was 21st among all U.S. universities – and 10th among private universities – in royalty and licensing fees with \$11 million (BNOB Biosciences Workgroup 2005, 14).

Xavier University and the University of New Orleans account for the majority of the balance of local NIH funding to universities.⁸ Xavier's clinical and research faculty numbered 200 before Katrina, and this group accounted for approximately \$8 million in NIH funding annually and another \$16 million in sponsored program research funding (BNOB Biosciences Workgroup 2005, 17). Major programs include one of the nation's most successful pharmacy schools⁹ and the Center for Bioenvironmental Research, a partnership with Tulane University.

⁸ Other recipients of major NIH funding include Children's Hospital, Ochsner Regional Medical Center, Dillard University, and two private bioscience firms.

⁹ A historically black university, Xavier holds one of only seven pharmacy schools in the Deep South. The highly competitive school produces 25 percent of the nation's African American pharmacists.

Figure 1. The Bio-Med Industry of Greater New Orleans



SOURCES: BDRP 2002 (Medical Complex), BNOB Biosciences Workgroup 2005 (Biotechnology Firms), NOLA Dashboard (hospital locations); NOTE: Out of 16 separate addresses listed, 13 were mappable as firm locations, with two firms located in St. Tammany Parish (not shown).

The University of New Orleans employed 45 researchers in bioscience-related fields, accounting for approximately \$5 million in NIH funding in addition to \$35 million in other sponsored program related revenue. In recent years, UNO has been increasingly active in projects to promote technology transfer and entrepreneurialism. UNO's Office of Technology Transfer resides in the UNO Research and Technology Foundation. UNO also holds a formal research affiliation with Children's Hospital through the Bioinformatics Center.

Biotechnology-related Economic Development Initiatives

This critical mass of universities and related institutions and, more directly, the high-skilled workforce and life sciences research generated within has been touted as a basis for growth, a regional strength unmatched throughout the Mid-South (BRDP 2002; BNOB 2006, 31). Consequently, many of the state's strategic interventions in biosciences-related economic development have sought to directly enhance the ability of universities to attract top researchers while boosting the hard and soft infrastructures required to gain research funding. Malecki (1991, 305) lists three economically beneficial outcomes from university enhancement policies: research findings lead to scientific innovations and general technological advancement, the development of a center of excellence in a certain field can enhance a favorable public image, and training provides a pool of labor which can be important to regional recruiting. While this may be sound educational policy, despite a few exemplary stories of local high-tech industries growing in tandem with universities, to expect innovative firms to cluster around knowledge centers is unrealistic (306). Fitzgerald and Leigh (2002, 54) agree that the presence of a major research university is a necessary but not sufficient component of biotechnology sectoral strategies. The variety of case studies presented earlier certainly portrays much more complex

forces at work in innovative regions. As discussed earlier, university enhancement strategies harken back to the linear model of innovation, containing little direct concern for the various geographical components of clusters, such as spillover effects, competition and complementarities, or innovative milieus. As recounted below, the most distinctly geographical concern running through recent biosciences policy has been to improve the downtown medical district, which houses LSUHSC, Tulane HSC, the Department of Veterans Affairs Hospital, Charity Hospital, Delgado Community College – Charity School of Nursing, and several other medical and research institutions.

Louisiana's attempt to promote the region's attractiveness for biotech development may be traced back at least to the mid 1980s (Economic Development Council 1985). State and local plans have always touted the region's strength in research and talent, highlighting the downtown concentration of research, education, and medical facilities in downtown New Orleans anchored by LSU and Tulane's Health Sciences Centers. Prior to Katrina, two groups served in an organizational role within the downtown Bio-Med district for economic development purposes. The New Orleans Medical Complex, Inc. (NOOrMC) – a private, 501 (c)(3) non-profit corporation that has organized and planned shared infrastructure and collaborative efforts among institutions with a stake in New Orleans' Bio-Med activities – shared similar member institutions and geographical boundaries with the Louisiana Biomedical Research and Development Park (BRDP), a commission established in 1991 by the state legislature to improve health care, to create jobs, and to encourage outside research investment (BRDP 2002). According to the BDRP's (2002) 10-year plan update, NOOrMC has a proven history of successful project management. NOOrMC's member institutions generated more than \$2.2 billion and 23,900 jobs through construction activities alone between 1992 and 2002 (BDRP 2002, 15). The BDRP, on

the other hand, remained largely inactive over the same period, with the notable exception of producing two planning documents. After the original planning phase and the establishment of the BDRP Commission in 1992, little implementation occurred in the next ten years, mainly due to a lack of funding (BDRP 2002, 8). The legislature provided substantial tax incentives, but it failed to appropriate funds to market and construct state-of-the-art facilities or to subsidize tenants' rent, access to venture capital, and incubator operating costs. Additionally, the state's mid-1990s Medicaid crisis, along with a looming general fund shortfall, necessitated restructuring and reorganization among BRDP member institutions and curtailed construction projects (BRDP 2002, 9). In the first decade, tax credits alone did not prove sufficient to attract firms and capital investment to the cluster.

Despite these challenges, several trends reinforced continuing optimism regarding the competitiveness of BRDP member institutions. Anchored by Tulane and LSU Health Sciences Centers, BRDP institutions have performed increasingly well with respect to the value of current contracted research (well over \$200 million) and the quantity of invention disclosures (approximately 100 in 2002) – success unmatched throughout most of the South (BRDP 2002, 15). The BRDP plan cites the success and popularity of similar initiatives in other cities and states and repeatedly warns against losing competitive advantage through inaction (BRDP 2002, 16, 19).¹⁰ A state-level plan for three wet-lab business incubators cites the existence of similar programs in 18 states (BDRP 2002 Appendix 4). Emphasizing that the presence of a local research university is simply not enough to offset shortcomings in entrepreneurial climate or venture capitalism, Malecki (1991, 344) hints at the limitations of New Orleans' relatively late

¹⁰ The 1992 comprehensive plan utilized a multiplier of greater than three to project the ripple effects of direct spending and employment of BDRP member institutions (BDRP 2002, 8). The 2002 update report also uses downward multiplier adjustments as evidence of the New Orleans Region's loss of economic diversity and, thus, the urgency of funding for cluster initiatives.

attempt to join the trend of encouraging spin-off biotech firms. To counter these shortcomings, incubator facilities address the capital risks of new companies and, given strict oversight by governing bodies, can dramatically improve a local entrepreneurship (349). While regional and local policies may struggle to generate high-tech entrepreneurship, incubators and capital pools may encourage entrepreneurs to stay in the area or, to a lesser extent, may attract firms from outside of the region. In fact, the state's biosciences incubator plan proudly cites evidence from the National Business Incubator Association, which shows that while only 20 percent of all business start-ups survive past two years, over 80 percent of businesses beginning operations in an incubator survive to "graduate" from the incubator and remain in the area. Additionally, the BDRP (2002, 29) plan lists six factors to foster such entrepreneurialism: quality building space with adequate capacity, shared experience and consultation, access to venture capital, improved access to specialized equipment, management support services, and real estate tax incentives. The first five are addressed in part by the proposed wet-lab business incubator; the last, by the BDRP/NOrMC's ability to lease land and by state tax credits currently offered to start-ups locating in research parks.

In its plea for greater funding commitment from the state, the BRDP plan situates the biomedical cluster within former Governor Foster's *Louisiana: Vision 2020* comprehensive plan for economic development, specifically within the context of its goals for economic diversification through technology (Economic Development Council 2003). *Vision 2020* makes heavy reference to the cluster model, echoed by the BRDP's attempt to align within the state's more recently drafted economic development plan: "The action component of a cluster strategy dramatically increases the communication between these various participants, in order to greatly

increase the business they do together and to establish linkages that make their efforts most competitive in the market” (BRDP 2002, 11).

The BRDP/NOrMC’s role, then, coincides with state and local goals for the biotech sector, one of the most important clusters targeted by *Vision 2020*. Accordingly, BRDP implementation directly relates to three overarching goals in *Vision 2020*. First, the BRDP intends to promote the broad objective of a “learning enterprise,” whereby highly educated employees generate efficiency and technological advances in the workplace while employers support access to continuing education (BRDP 2002, 12). Second, by coordinating the efforts of medical education programs, the BDRP intends to support diverse and thriving technology-intensive industries that actively utilize Louisiana’s colleges and universities as a source for graduates, expertise, and technology suitable for commercialization (BDRP 2002, 13). And third, the BDRP intends to improve the standard of living in Louisiana, which implies increasing the quality and quantity of jobs and decreasing unemployment and poverty in each region of the State (BDRP 2002, 13). However, the BDRP has remained a largely inactive organization, leaving the region devoid of the necessary type of biotech-specific, business-oriented leadership, advocacy, and networking organization that has keyed the emergence of new innovative biotech regions in the 1990s and 2000s. Tommy Kurtz, GNO, Inc.’s senior vice president over job development, says that New Orleans needs such an advocate group to focus resources on biotechnology strategies: “There is really no coordinating entity that is linking everything together and representing the business side or really has that business component” (*Biz New Orleans*, 11 April 2005). In contrast to the strong leadership in regions like San Diego (where CONNECT has become a national model), Research Triangle Park, New Haven, Baltimore-Washington, and Seattle, Walcott (1999) writes that Atlanta’s lack of such leadership critically

retards the local cluster's development. Additionally, when compared with Atlanta and its steady growth as a Sunbelt city in recent decades, New Orleans has, in many ways, lost an amount of economic diversity, which researchers emphasize is necessary to support an innovative, entrepreneurial cluster (Glasmeier 2000; Malecki 1991).

Still, the state has made some progress in recent years toward supporting economic development through the university research agenda and in fulfilling the BDRP plan's plea for a biotechnology incubator in the New Orleans CBD. The legislature established the Louisiana Gene Therapy Research Consortium (LGTRC) as a partnership among LSUHSC-New Orleans, LSUHSC-Shreveport, and Tulane University Health Sciences Center to help lure top research talent and funding for cell and gene therapy research and production and to encourage entrepreneurship. The partnership's broad goal is to promote statewide economic growth and job creation, and its programs employ 152 individuals and have brought grants totaling more than \$36 million into the state (BNOB Biosciences Workgroup 2005, 28). The LGTRC also has worked to establish a Good Manufacturing Practices compliant facility (GMP), which manufactures gene and cell therapeutics for use in clinical trials. The GMP aims to attract firms as customers, some of whom hopefully would perform clinical trials or even locate facilities in the state.

Additionally, the GMP is an important component of the state's largest biotechnology initiative to-date, a network of three biotechnology incubators in New Orleans, Shreveport, and Baton Rouge, offering a total of over 180,000 sq. ft. of wet lab space as well as traditional office space. Accounting for one third of the state's initial \$30 million investment, the New Orleans BioInnovation Center differs from the other versions in that it is also viewed as an investment in downtown redevelopment. Looking beyond the expected economic impact of 200 new jobs,

Arthur Cooper, CEO of the LSU System Research and Technology Foundation in Baton Rouge, highlights the “urban renewal” component of the New Orleans facility: "Unlike the facility in Baton Rouge, the BioInnovation Center is really part of an urban renewal strategy; because the center will be located downtown, the BioInnovation Center will help attract researchers and redevelop a part of the city" (Kral 2006). This notion generally correlates with Malecki’s (1991, 310) contention that business incubators and science parks serve more as real estate policy than as technology policy. In New Orleans’ case, an incubation “place” will supplement existing but more passive and fragmented incubation “policies” to encourage entrepreneurship through academic research institutions and incentives (Blakely and Nishikawa 1992). Blakely and Nishikawa (1992) stress that such places – brick-and-mortar investments such as the BioInnovation Center – can shape a plausible role for economic development, where the public sector fills a structural gap by intervening at early stages in a firm’s life cycle. In this sense, localities mobilize the “incubator metaphor” as a process model, influencing policy choices to meet individual needs, rather than as a standard, discrete checklist item for biotechnology strategies. Still, some degree of faddism certainly has characterized the proliferation of biotechnology incubators and GMP facilities, since many regions list similar facilities among their assets. For example, North Carolina’s successful incubator has operated for the past 25 years, and Houston alone currently claims four GMP labs (Blakely and Nishikawa 1991, 250; Kral 2006).

The BioInnovation Center will house the LGTRC’s GMP facility. Additionally, a multi-purpose, full-service Wet Laboratory Incubator, operated as a community resource to nurture new businesses, would facilitate the transformation of intellectual property created in universities and research institutions into start-up companies (BRDP 2002, 31). Under one roof, the

BioInnovation Center would house incubator services – such as subsidized rent for start-ups, business consulting, and streamlined access to funding sources – and access to testing facilities to reduce fixed costs. The Center’s proponents have stressed proximity in locating the facility in the downtown medical district. The BDRP plan suggested conversion of the long abandoned Wirth Building on Canal Street, a location that contributes to wider efforts of downtown redevelopment (BRDP 2002, Appendix A: 5). Also, the structure’s size allows for the inclusion of market-rate tenants in addition to subsidized businesses that would benefit directly from shared wet lab facilities and business development services. The BioInnovation Center’s focus on business development demands that recruitment efforts target businesses at an early stage of product development. For example, during early stages, many biotech firms in the New Orleans Area have had to subcontract testing facilities in other areas (*Biz New Orleans*, 11 April 2005). The BioInnovation Center would help to tie this function to the local medical cluster and to facilitate the success and retention of existing and new local businesses. In the words of Stephen Moye, CEO of LGTRC, the center provides a hard infrastructure component of the “value chain” which local biotech initiatives have tried to fashion (Kral 2006). The BDRP Plan estimated that renovations and wet lab construction would be completed by summer, 2004, at a cost of \$15 million (BRDP 2002, Appendix A: 2,7).

The state legislature approved funding for the BioInnovation Center, along with similar facilities in Baton Rouge and Shreveport, in 2002 as part of the Governor’s Biotechnology Initiative. While Shreveport’s BioSpace 1 commenced operations in late 2005, followed by Baton Rouge’s Louisiana Emerging Technologies Center in 2006, the New Orleans BioInnovation Center suffered several holdups, even before Katrina. Structural problems with the Wirth Building led engineers to determine that the structure was not suitable for the heavy

equipment and space required for the laboratory. Instead, the Wirth Building was demolished to allow an entirely new, 130,000 square foot structure to be completed by mid-2007 at a cost of \$30 million. With the Louisiana Gene Therapy Research Consortium initially acting as an anchor tenant, the BioInnovation Center is expected to create 200 jobs, but supporters are even more optimistic about its long-run effects from successful business ventures that eventually “graduate” from the incubator. Citing statistics that claim the existence of 7000 unfilled medical-sector jobs in the city, Mayor Nagin’s comments at the Wirth Building’s demolition ceremony summarize this position: “What we are doing today is what I’m calling our Nissan plant. If we do what we are talking about today, we can double those [7,000] openings” (*Biz New Orleans*, 11 April 2005). Here, Nagin blurs the distinction between medical jobs and biotechnology jobs; but while these industries may rely on the same institutions, they exist at entirely different ends of the production chain. Biotechnology initiatives seek to bridge the gap between university research and entrepreneurialism while medical employment intends to link a skilled workforce with regional, state, and federal health care systems. Thus, the prospect of creating and filling opportunities in each sector structurally differs. This degree of confusion is compounded by the early lack of leadership in the biotechnology industry. By comparison, Shreveport’s Biomedical Research Foundation of Northwest Louisiana, established in 1986, succeeded in passing a property tax to fund the InterTech Science Park, a cluster built around Shreveport’s Charity Hospital and LSU Health Sciences Center, which now houses a biotech incubator. The Foundation funnels substantial assets and resources to the park and, equally as important, provides leadership that has helped to advance completion of Shreveport’s Wet Lab Incubator facility.

In a third major initiative, using a \$40 million bond financed by a new cigarette tax in 2002, the state legislature created another partnership between LSUHSC-New Orleans and Tulane University HSC, the Louisiana Cancer Research Consortium (LCRC), with the goal to create a medical and scientific center for cancer research that will be recognized as the state's only National Cancer Institute (NCI)-Designated Cancer Center. The LCRC's goals are to promote better health outcomes, to enhance research and education, and to provide economic diversity and career opportunities for Louisiana university graduates. Beyond university research faculty support functions, the LCRC is planning and developing a 160,000 square-foot Cancer Research Center in New Orleans to provide shared core equipment and services with a projected financial impact of \$350 million over five years (BNOB Biosciences Workgroup 2005, 29). In March, 2005, the LCRC acquired the final piece of land for the cancer center site, an undeveloped parcel near the existing medical district, with construction then scheduled to begin before the end of 2005 (LCRC 2005, 2).

Together, the BioInnovation Center, the LGTRC, and the LCRC, represent major investments in biosciences. These institutions reflect an institutional approach to enhancing university research as an economic base, and the state's investments of over \$60 million, in a sense, reflect a linear conception of innovative growth along a "value chain" (BNOB Biosciences Workgroup 2005, 7). Through the LGTRC and LCRC, the state hopes to recruit scientists and to acquire higher levels of research funds. The BioInnovation Center, then, would boost the potential for successful commercialization technologies developed in universities and research centers – or converting basic research to applied research and retaining subsequent economic gains within the state and, more directly, within the New Orleans region. However, as the literature review in this thesis suggested, successful biosciences bases depend on much more

than such soft and hard infrastructures to support a linear model of innovation. The next section investigates the existence of a “local innovative milieu” from the perspective of the region’s capacity for entrepreneurship and employment in biosciences.

Labor Force and Entrepreneurialism: A Local Milieu for Innovation?

In 2002, New Orleans’ universities graduated 1,053 students in biotech-related fields, notching the region at 25th in the country in terms of total graduate output (BNOB Biosciences Workgroup 2005, 32). Comparing this number against regions with similarly sized labor forces, New Orleans only trails the metropolitan areas of Raleigh-Durham and Austin. Other parts of Louisiana generated approximately 950 biotech-related graduates in 2002. Table 2 presents several location quotients and rankings culled from a GNO, Inc. biotech workforce evaluation in 2005, and Table 3 presents a breakdown by university. The metro area also ranks 23rd in terms of PhD graduates and 26th in terms of Professional-level graduates in biotech-related fields. These numbers suggest that, if New Orleans developed a substantial biosciences cluster, the region would be well positioned to provide the necessary skilled workforce, assuming a significant level of graduate retention.

Prior to Katrina, however, New Orleans’ biotech-related employment lagged significantly behind its output of an advanced workforce. A 2004 survey of 20 firms in the New Orleans Area – constituting a majority of regional biotech employers¹¹ – conducted for GNO, Inc. reported a total employment of about 900 workers, primarily laboratory technicians/technologists, research specialists, research scientists. This number had grown steadily in the previous few years, tracking closely to employment growth reported by the Bureau of Labor Statistics, and was

¹¹ A 2004 study for GNO, Inc. estimated a total of 24 regional biotech firms (BNOB Biosciences Workgroup 2005, 36).

Table 2. Biotech-related Graduates in Greater New Orleans Area

<i>Degree</i>	<i>Level</i>	<i>Bio Grads</i>	<i>Location Quotient**</i>	<i>Rank*</i>
Biology/Biological Sciences, General	Bachelor	378	2.06	4
Pharmacy	Professional	107	1.04	26
Chemistry, General	Bachelor	82	2.04	10
Cell/Cellular Biology and Anatomical Sciences	Bachelor	68	10.19	7
Epidemiology	Master	67	21.70	3
Biomedical/Medical Engineering	Bachelor	38	6.20	9
Clinical Lab. Science/Medical Technologist	Bachelor	27	4.27	12
Chemical Engineering	Bachelor	23	.99	30
Chemistry, General	Ph. D.	21	1.96	9
Cardiovascular Technology/Technologist	Bachelor	21	123.51	1
Biostatistics	Master	18	38.11	1
Neuroscience	Bachelor	18	4.58	22
Biochemistry	Bachelor	18	1.17	73
Cell/Cellular Biology and Anatomical Sciences	Master	17	26.52	1
Pharmacology	Master	16	29.33	1
Cell/Cellular Biology and Anatomical Sciences	Ph. D.	12	9.28	3
Biomedical/Medical Engineering	Master	11	2.89	24

SOURCE: "Biotech Workforce Evaluation," Greater New Orleans, Inc., 17 January 2005; retrieved October, 2006, from <http://www.gnoinc.org>.

*Location Quotient is defined as the ratio of the local percentage of total graduates in biotech-related fields to the national percentage of total graduates in biotech-related fields.

**Blended rank based on absolute number ranking and percentage of total graduates ranking.

Table 3. Largest Biotech-related Degree Programs in Greater New Orleans Area

<i>University</i>	<i>Biotech-related Graduates*</i>	<i>Major Biotech-related Education Programs</i>	<i>Major Areas of Bioscience Research</i>
LSUHSC	81	Biochemistry Cardiovascular Technology Clinical Laboratory Science Genetics Microbiology/Bacteriology Neuroscience Pathology	Cancer Molecular and Human Genetics Neuroscience Oral and Craniofacial Biology
Loyola	43	Biochemistry Chemistry	
Tulane	369	Cellular Biology Epidemiology Biomedical Engineering Chemical Engineering Neuroscience Biostatistics Biology Pharmacology Chemistry Biochemistry	Bioenvironmental Research Cancer Cardiovascular Health Gene Therapy Genetics Infectious Disease Primate Research Tropical Medicine
UNO	115	Biology Chemistry Cellular Biology Biomedical Engineering Biostatistics Conservation & Molecular Genetics	Bioinformatics
Xavier	378	Biochemistry Biology Chemistry Pharmacy	Bioenvironmental Research Clinical Science Pharmaceutical Science

SOURCE: SOURCE: Biotech Workforce Evaluation, Greater New Orleans, Inc., 17 January 2005 (<http://www.gnoinc.org>)

*Integrated Postsecondary Education Data System (IPEDS), National Center for Education Statistics, U.S. Department of Education.

projected to continue to grow (BNOB Biosciences Workgroup 2005, 36). Most of the region's 20-plus biotech companies average between 3 and 5 employees, although two companies, Reliagene Technologies and Pam Lab, employ over 70 and 100 people, respectively (20). Figure 1 maps each of these 20 companies' addresses as listed in the Bring Back New Orleans Commission's Biosciences Workgroup Report (2006). Of the 20 firms, 13 provided separate addresses.¹² From a cursory look at the admittedly partial map, no physical clustering patterns are apparent with respect to intra-regional firm location, with firms situated variously throughout the area's small-office landscape and not, for example, concentrated near the downtown medical district or in other nodes. As Walcott describes in her work on biosciences industries in San Diego (2002) and Atlanta (1999), real estate is a central concern for biotech firms, alternately locating near university research centers or in peripheral suburban employment and residence nodes, depending on inter-firm and university linkages, the need to access incubator services, facility requirements determined by the firm's stage in the development process, etc. At this stage, New Orleans' nascent industry does not appear to be significantly clustering around the downtown medical district or otherwise exhibiting spatial characteristics of agglomeration economies.

Aside from the hard spatial features of an innovative cluster, Louisiana has also traditionally lacked a strong culture of entrepreneurship. This partly results from access to venture capital, which has historically been problematic and in short supply (BNOB Biosciences Workgroup 2005, 38). Table 4 reports Louisiana's rankings in utilizing two competitive government grant programs for small business' wishing to commercialize technological innovations, the Small Business Innovation Research (SBIR) and Small Business Technology

¹² Four of the incorporated entities listed were located at the same address. Others provided P.O. Boxes or no addresses.

Table 4. SBIR and STTR Funding in Louisiana and Nation, 2000-2004

	<i>Year</i>	<i>Louisiana Rank</i>	<i>Total grant Money for State</i>	<i>Total Federal Dollars Available</i>	<i>Percent of Total</i>
SBIR	2000	42	\$2.2M	\$1.1B	0.20%
	2001	39	\$3.9M	\$1.2B	0.26%
	2002	40	\$3.2M	\$1.5B	0.22%
	2003	44	\$3.4M	\$1.8B	0.13%
	2004	45	\$3.8M	\$2.0B	0.19%
STTR	2000	50	\$0	\$63K	0.00%
	2001	37	\$100K	\$62M	0.16%
	2002	50	\$0	\$95M	0.00%
	2003	29	\$599K	\$102M	0.59%
	2004	47	\$169K	\$209M	0.08%

SOURCE: SBA (<http://www.sba.gov/sbir/index-sttr.html>), reported in Bring New Orleans Back Commission, "Biosciences Workgroup Report," 20 December 2005.

Transfer (SBTT) programs. The developed high-tech environments of California and Massachusetts account for the majority of the funds, while only a small fraction accrues to low-ranked states like Louisiana. However, private sources account for considerably more investment than government programs, and private financing networks shape the locational tendencies of biotech areas. Mindful of their investment portfolios, venture capital firms prefer the proximity and trust embedded in an innovative milieu. In a sense, these linkages are “untraded interdependencies,” reflecting the importance of knowledge of not only the sort that is created and dispersed by researchers and educational institutions but also of the level of investor confidence and entrepreneurial know-how.

Private funding sources include two related categories of angel investors and venture capital. Angel investors, usually wealthy individuals and/or successful entrepreneurs themselves, usually invest a few hundred thousand dollars in seed capital at an early stage and offer assistance in drafting a business plan, with the intention to help the young firm secure more stable sources of venture capital. Angel investments are generally not considered significant in Louisiana, although recent groups have attempted to address the shortage.¹³ Likewise, the state has historically been deficient in access to venture capital, which the BNOB Biosciences Working Group (2006, 39) attributes to “a relative lack of community support for new technology companies, the lack of strong support for the spirit of entrepreneurship within the university environments, and weak leadership from the local finance community.” Table 5 shows that, in recent years, the state often receives less than one tenth of one percent of national venture capital investments. Between 1990 and 2005, only two known biotech deals occurred in Louisiana, totaling \$5 million (39). Recently, the state has attempted to provide incentives for

¹³ Most notably, the Louisiana Angel Network has been established an attempt to increase awareness and to link potential investors with firms in need.

Table 5. Venture Capital Funding in Louisiana and Nation, 1996-2004

<i>Year</i>	<i>Number of Deals</i>		<i>Total Investment (\$Millions)</i>		<i>Louisiana Share of Total Investment (%)</i>
	<i>Nation</i>	<i>Louisiana</i>	<i>Nation</i>	<i>Louisiana</i>	
1996	2465	3	10807.5	10.7	0.10
1997	3083	9	14649.9	26.5	0.18
1998	3555	8	20745.4	68.0	0.33
1999	5396	9	53454.4	294.0	0.55
2000	7812	14	104402.1	112.7	0.11
2001	4464	10	40532.8	80.5	0.20
2002	2610	6	21777.4	19.3	0.09
2003	2409	1	19646.5	1.2	0.01
2004	2566	3	22098.4	3.2	0.01
2005	2637	3	22736.9	2.5	0.01
2006	2277	2	19243.1	2.0	0.01

SOURCE: 2006 PricewaterhouseCooper/Venture Economics/NVCA MoneyTree Survey, data current as of 18 October 2006; retrieved October 20, 2006, from <http://www.pwcmoneytree.com>.

venture capital through tax credits on investments up to \$1 million. Meanwhile, three new venture capital funds – Louisiana Fund I, Louisiana Ventures, and the Louisiana Technology Fund – have been established within the state, while GNO, Inc. and the Louisiana Department of Economic Development have established the Capital Village to try to attract out-of-state venture capitalists to connect with in-state entrepreneurs.

Even with recent attempts to address lagging investment, the dominant wisdom on biotech clusters and innovative environments in general shows that public funds, while important for strategically filling early-stage funding gaps for new firms, are no substitute for private investment. Private investment depends critically on less quantifiable shortages, such as a lacking “spirit of entrepreneurship,” and consequently resists easy answers. Moreover, New Orleans’ university strengths may address a pre-condition for a thriving biotech industry, but studies show that a research university is a necessary but not sufficient foundation for high-tech entrepreneurship. In most biotech environments, a public agenda to support research commercialization has largely followed rather than led cluster formation. These reasons certainly provide evidence to temper optimism for New Orleans’ attempt to fashion a biosciences base for economic development, despite recent initiatives to strategically enhance the university research agenda and provide an incubation infrastructure for fostering start-ups. Rather, as described in earlier literature reviews, development depends on a whole host of other factors, including regional agglomeration as represented by economic diversity, a well-trained workforce, attractive infrastructure, access to venture capital, and a local climate of entrepreneurialism. Of course, most scholarship on the highly concentrated biotech and biosciences-oriented economic development remains biased toward the best performing regions, partly because these areas display a new history of development, often in stages as the local

industry matures. In New Orleans, on the other hand, according to Aaron Miscenich, director of the BioInnovation Center, “nothing really exists; there is no commercialization of products right now,” notwithstanding a handful of mostly very small businesses (Kral 2006). As described in the next section on New Orleans’ post-Katrina environment, it seems unlikely that a major urban disaster would fit constructively into a future biotechnology success story.

Post-Katrina Challenges and Opportunities

In the first year after Katrina, the New Orleans area Bio-Med industry, as defined above, has provided a major focus of post-Katrina recovery efforts. Since the storm’s aftermath physically decimated health facilities and displaced care providers along with roughly half of the city’s total population, access to health care remains one of the most immediate issues in day-to-day life and, along with housing supply and storm protection, a primary area of questions regarding whether New Orleans holds sufficient infrastructure to support large-scale repopulation. Looking more toward economic recovery and growth, the Bio-Med industry remains targeted for efforts to diversify the city’s economic base. While major planning efforts are currently underway, many uncertainties remain. This section will assess damage to the city’s health care infrastructure and positioning as a regional center for life sciences R&D as they relate to a program for economic development. Unquestionably, Hurricane Katrina and the recovery effort will dramatically reshape the future of the Bio-Med industry in general and the downtown medical complex in particular. Accordingly, this section assesses the recovery status of New Orleans’ biomedical complex as an economic development project and, more generally, the implications of a concurrent attempt to rebuild the city’s health care infrastructure after Katrina. In the economic development framework sketched out by the Bring Back New Orleans

Commission, clusters remain at the heart of the concepts at work in the Bio-Med sectoral strategies:

The Bio-Med industry is commonly thought to have a synergistic effect, causing the value of the combined industries to be more than the value of each individual component. Pre-Katrina, New Orleans had in place a bio-med district – a physical corridor where hospitals, medical schools and research facilities were concentrated. The concept of a bio-med corridor or “district” is vital to the future of a health sciences industry in New Orleans because the success, recognition and growth of hospitals, medical schools, research facilities and emerging biotech companies are strongly interdependent (BNOB 2006, 29).

This passage underscores the importance of interdependency among institutions, firms, and universities, as well as the necessity of economic diversity arising from agglomeration economies. However, the role of a compact, discretely bounded, physical district in an industry primarily sorted into the softer, more conceptual geographies of region-wide clusters remains unclear, especially since Katrina not only directly damaged the Bio-Med district but also severely impacted broader regional economic processes.

Damage to the Foundations of the Bio-Med Industries

Attempts to describe the hurricane damages are prone to expiration, since the situation continues to change rapidly. However, this section briefly describes the disaster’s impact as it relates to the New Orleans’ Bio-Med industry, highlighting the extent of challenges to building on pre-Katrina momentum in the biosciences field. At the broadest level, Hurricane Katrina dramatically reduced New Orleans’ population from about 450,000 in 2000 to fewer than 190,000 in summer 2006 (Louisiana Health and Population Survey 2006).¹⁴ More specifically, the storm dealt a crippling blow to the state’s biosciences institutions, damaging infrastructure

¹⁴ In disagreement with the household survey count of around 190,000, Mayor Nagin argues for a population estimate of around 230,000, based on earlier analyses of other numbers, such as utility use (*Times Picayune* [New Orleans], 27 September 2006).

and displacing employees at most of the region's hospitals, medical schools, and research centers. Lost revenue and, in some cases, declining student bodies forced massive restructuring of academic programs. UNO's fall 2006 enrollment stood at roughly two-thirds of pre-Katrina levels, and revenue shortfalls from lost student revenue and state-funding cutbacks, in addition to over \$100 million in damages, forced 700 layoffs or furloughs of part-time or adjunct faculty and non-essential staff, several academic program reductions, and a halt to construction of a new biotech laboratory (BNOB 2006, 32-34). Tulane's losses exceeded \$250 million, and the university has reduced faculty and staff by approximately one third since the storm (LRA 2006a). Tulane University's downtown institutions, including the School of Medicine and Tulane Hospital, have reopened in phases; but the school expects a significant budgetary shortfall for 2006 (BNOB 2006, 34). Overall, as of January 2006, losses to universities included over 1800 faculty and staff, \$223 million in revenue, and \$367 million in faculty and staff salaries and benefits, a major blow to the entire urban economy (35). Xavier, Tulane, UNO, and LSUHSC all suffered massive damage to their biosciences research facilities, fracturing the hard infrastructural support for the local knowledge base required to support innovation.

Another major event has been the decimation of the city's health care system, as several area hospitals have closed. Figure 1 compares the locations of hospitals before Katrina with open facilities as of October 2006. Consequently, access to health care remains one of the central preoccupations of the recovery effort. Charity Hospital, one of the nation's oldest medical institutions most recently under the administration of LSUHSC, represents the most notable closure. LSUHSC furloughed 2,600 workers at Medical Center of Louisiana-New Orleans (MCLNO, which includes Charity and University hospitals) after the storm, and the future extent of LSUHSC's presence in the regional health care system remains undecided.

Charity Hospital, in particular, has long served as an enticing location for medical residencies, playing an important role in recruiting care providers to the regional health care system. In any case, losses to local educational, research, and clinical programs will likely continue to disrupt the flow of research funding and hinder the ability of local medical schools to attract post-graduate residents, further undermining their ability to compete for clinical and research funding and faculty. Additionally, the availability of funding for LSU and Tulane's graduate medical education (GME) programs through clinical practice, such as Medicare reimbursements from hospitals to universities, remains in a state of flux. At the same time, the burden of uncompensated care traditionally handled through the Charity System has shifted to the area's private hospitals.

Hurricane Katrina further delayed construction of the BioInnovation Center and its component GMP facility for the LGTRC. While the site remains prepared for construction, higher construction costs have increased the facility's price by an estimated \$20 million, which may result in a redesign of the center. The storm also interrupted the bond financing mechanism for the LCRC facility, now expected to require an additional \$70 million, and postponed the start of construction (LCRC 2005, 3).

Perhaps the most substantial hurricane impact as it pertains to biotechnology-based economic development involves broad quality of life issues. From the health care system to the school system, from infrastructure damages to the loss of residents and businesses, from increasing utility costs to lingering questions about the levee system's ability to guard against another major storm surge event, New Orleans remains in a state of upheaval more than one year after Katrina. In virtually all cases, quality of life has proven to be a more important component of attracting and retaining a skilled workforce for innovative industries than more quantifiable

and controllable variables, such as tax incentives, incubator facilities, and cutting edge research. With respect to quality of life, New Orleans likely will remain uncompetitive for the short-to-medium term even in the best-case recovery scenario. Nevertheless, as reviewed in the next section, several post-hurricane initiatives stand to shape the future of the Bio-Med industries in the Greater New Orleans Area.

General and Biosciences-specific Planning Projects Since the Storm

As the initial disaster response subsided, funding and planning the recovery and rebuilding effort emerged as a central issue. In some ways, the recovery political economy acts through a substantially altered calculus for decision-making, with competition between the agendas of separate public agencies and private interests occurring at federal, state, regional, and local levels. At the same time, while the hurricane-affected areas suffered massive damage to real estate, infrastructure, private industry, and human capital, the state holds the balance of discretion over spending large sums of federal money for redevelopment. Often, tensions have arisen between the desire to rebuild what existed before the storm and the notion that the effected areas, New Orleans in particular, should rebound into a more economically and environmentally sustainable – in other words, smaller – landscape. Of course, the boundaries of these competing visions are subject to interpretation and, thus, disagreement, especially with the rebuilding project's immensely unprecedented scope. In many ways, the expression of these tensions harkens back to a history of political antagonism between the city of New Orleans and the state at large. While a complete account of post-Katrina planning efforts is well beyond the scope of this section, a brief summary of planning efforts relating to the biosciences and health care introduces new challenges and opportunities for change in the post-Katrina environment.

The federal government has provided recovery funds primarily through flexible Community Development Block Grants, to be spent at the discretion of the state government. The Small Business Administration (SBA) has also provided loans targeted to reestablishing local businesses. Meanwhile, Congress responded with the Gulf Opportunity Zone Act (GO Zone) to provide substantial incentives for businesses in the effected areas. The federal government has exerted influence through Gulf Coast Recovery Czar Donald Powell and in the realm of health care through Secretary of Health and Human Services Michael Leavitt.

At the state level, Governor Kathleen Blanco established the Louisiana Recovery Authority to direct the spending of hurricane recovery funds. The LRA's decisions, currently in the task force committee process, must also receive federal approval. The Road Home grant program for housing renovations remains the LRA's highest-profile program, but its committees are considering nearly every type of hurricane recovery initiative. In October 2006, the Recovery Workforce Training Program, organized by the LRA and other state-level economic development agencies with \$38 million in CDBD funds, began accepting applications from regional workforce intermediary organizations to train workers to match high demand in key sectors, including health care and construction (LRA 2006b).

At the local level, several massive planning efforts have sought to guide future redevelopment, under the direction of the mayor, the city council, and most recently through the Unified New Orleans Plan. Offering perhaps the most prominent effort, especially during a reelection campaign, Mayor Nagin's Bring New Orleans Back Commission (BNOB) released final reports in January 2006, with the aim of guiding requests for funding from the LRA and Congress. This thesis has relied heavily on the BNOB report on economic development. Even more specifically, the BNOB Technology Subcommittee Biosciences Workgroup Report,

released separately from the comprehensive final BNOB report, provides the most current available assessment of the industry and compares favorably with pre-Katrina reports, such as the rosier BDRP plan, with respect to its attempts to strategically address the complexity of regional biotechnology industries and the extent of obstacles facing implementation.¹⁵

Potentially, the process of constructing this report through the Technology Subcommittee could lay the basis for future collaboration toward building the effective leadership structures that have proven necessary to support biotech clusters in other locales, especially as the BioInnovation Center finally approaches completion. In comparison to the Biosciences Workgroup Report, the BNOB's economic development report on the Bio-Med industry – which drew on the Biosciences Workgroup in combination with reports on the health care industry – suffers from the common tendency to engage flexible definitions of terms like “biomedical,” “biosciences,” and “biotechnology” on the local level (Cortright and Mayer 2002). More recently, the U.S. Department of Commerce has provided the New Orleans Regional Planning Commission (RPC) with a \$300,000 grant to formally assess the regional biotechnology and biosciences industries and to recommend a strategy for catching up not only with other parts of the nation but with the more advanced initiatives in Shreveport and Baton Rouge. Due for completion in Spring 2007, the RPC study and the process involved in its creation could lead to a more coordinated activist leadership structure for the local industry.

Finally, the state has attempted to use Katrina's decimation of the essential health care infrastructure as an opportunity to plan a new health care system for the New Orleans region. The next section summarizes this restructuring effort, with particular attention to the competing agendas of various regional, state, and federal entities shaping the process. Ultimately, these

¹⁵ Admirably, the Biosciences Workgroup also includes a note of clarification regarding the common pitfalls arising from vague definitions.

efforts have drastic implications for the Bio-Med industry in general and, by extension, for New Orleans' attempts to foster biosciences and biotechnology as a base for economic development.

Restructuring Regional Health Care After Katrina

As of Fall 2006, the effort to restructure New Orleans' health care system has gained significant traction and stands to reshape the future of graduate medical education and employment in the largest category of jobs included in the regional Bio-Med industries. US Health and Human Services Secretary Michael Leavitt has prominently advocated for a reforming a system that was "fraught with inefficiency" long before Katrina decimated its physical and human infrastructure (*Times Picayune* [New Orleans], 18 July 2006). Critics-turned-reformers frequently point to the existence of a "two-tiered" system of health care in Louisiana, where low-income populations direct the vast majority of Medicaid and indigent dollars to the antiquated state-run Charity system while middle- and upper-income populations direct private insurance and Medicare dollars to private hospitals and primary care clinics, which habitually provide a relatively poor quality of care at high per-unit costs when compared against national benchmarks for private facilities (Pricewaterhouse Coopers 2006). Similarly, crowding has historically characterized public-sector facilities, most notably in the case of low-income New Orleanians' traditional reliance on Charity's emergency rooms for primary care, while private-sector beds have remained underutilized. At the state level, Louisiana routinely ranks near the bottom of national public health ratings, including the extent of insurance coverage. A report by Pricewaterhouse Coopers commissioned by the LRA locates much of the statewide inadequacy on the supply-side with medical workforce characteristics. In 2003, Louisiana had 11,000 unfilled statewide healthcare openings (Pricewaterhouse Coopers 2006, 99). With

respect to MDs, New Orleans' region (Region 1) held by far the state's highest physician to population ratio, especially for specialty physicians.¹⁶ According to this report, high specialty physician concentrations in New Orleans (Region 1), Baton Rouge (Region 2), and Shreveport (Region 9) have distorted statewide levels, masking a shortage of specialty physicians in other more rural regions and a shortage of primary care providers throughout the state. Allied Health professionals display similar patterns. These spatial inconsistencies likely owe to the location of teaching institutions, teaching hospitals and medical schools in particular, and the tendency for medical providers, residents, and skilled medical workforce to agglomerate in a given locality for reasons relating to institutions, local market determinants of supply and demand for services, and path dependence – in other words, reasons not entirely dissimilar to the biotech cluster model examined above or any other type of agglomerative economic activity. Moreover, the example is important in that it demonstrates competing priorities among agencies charged with guiding the recovery and reform of Louisiana's health care system. When observing a concentration of physician specialists and Allied Health professionals, local economic development interests might discern competitive advantage as a regionally prestigious health center; but as the Pricewaterhouse Coopers report reflects, health care advocates might perceive inefficiency and spatial inequity within a system primarily organized at the state level. Unquestionably, this dynamic will shape the Bio-Med industry in the New Orleans Area as well as more specific efforts to cultivate the downtown medical cluster. New Orleans houses two of the state's three medical schools (LSUHSC and TUHSC) as well as several other institutions ranging from nurse training to technician programs that provide the vast majority of the region's skilled medical workforce, in addition to their capacities in biosciences-related research.

¹⁶ The Louisiana Department of Health and Hospitals (DHH) defines Region 1 as Orleans, Jefferson, St. Bernard, and Plaquemines Parishes.

Two major projects are underway to dramatically reshape access to health care in New Orleans. An early draft of the LRA-sponsored Pricewaterhouse Coopers report claimed an “overbuilt” public health infrastructure in the New Orleans region and proposed scaling-back LSU’s involvement, casting doubt over the revitalization of the downtown medical cluster (*Times Picayune* [New Orleans], 25 April 2006). At the same time, the LSU-run Charity Hospital has habitually provided primary care for the city’s uninsured; and its closure has scattered medical services to private clinics and hospitals where uncompensated care has risen 86 percent, even as many health care practitioners have left the city (*Times Picayune* [New Orleans], 5 June 2006). Claiming irreparable damage to Charity Hospital and seizing the opportunity to finance a state-of-the-art clinical and teaching facility to meet current standards, LSU has partnered with the federal Department of Veterans Affairs (VA) to propose a new joint medical complex to replace both institutions’ downtown hospitals at an estimated cost of \$1.2 billion, with Governor Blanco voicing support (*Times Picayune* [New Orleans], 20 June 2006). Roles intended for the complex near the existing downtown medical district include conducting research, training medical students and residents, and treating uninsured patients who, before Katrina, would have gone to Charity Hospital. The federal share of financing, over \$630 million on the part of the VA, has already been appropriated by Congress; and LSUHSC is seeking to finance their roughly \$650 million share through a combination of grants from CDBG recovery funds, reimbursements from insurance and FEMA for damage to Charity and University Hospitals,¹⁷ and loans and bonds to be retired through patient revenues. Sufficient revenue, however, depends on the hospital’s ability to attract more paying patients than the pre-Katrina version of LSU’s hospital system, where only 56 percent can pay for care through Medicare,

¹⁷ FEMA initially estimated damage to Charity at \$27 million, while LSU claims well over \$100 million.

Medicaid, or private insurance. In an October hearing of the LRA health care and infrastructure committees, committee members voiced skepticism regarding the need for an expensive new facility in an area “over-bedded” even before Katrina’s massive population loss, especially where the Charity and University hospital sites and their 551 combined beds would be left vacant (Pricewaterhouse Coopers 2006). Leery of long term financing risks, the state legislature has also questioned the merits of the project. LSUHSC, on the other hand, envisions their proposed 350-bed hospital as a location for specialty services and a partial answer to the gap left by Charity’s closure. LSUHSC also cites the importance of such facilities for maintaining institutional prestige for research and clinical programs and for attracting residents to fulfill the LSU’s role in the state health care system as the primary provider of graduate medical education. Further, the complex could deliver massive repercussions throughout the local economy. Initially, construction could generate as many as 19,000 jobs with a \$2 billion impact, and the complex could employ about 6,000 full-time workers, with an annual impact of \$1.2 billion following expected completion in 2012 (*Times Picayune* [New Orleans], 2 November 2006). At the time of this writing, the future of the proposed LSU facility remains uncertain. Nonetheless, the final result will certainly shape the downtown medical cluster. The proposed facility could potentially provide urban infill in a large, undeveloped tract immediately adjacent to the existing downtown medical complex. Along with the BioInnovation Center’s completion, a new LSU hospital could push the Bio-Med industries to the forefront of efforts to redevelop a portion of downtown, specifically the area around upper Canal Street, largely excluded from development in recent decades. Long viewed as an obstacle to redevelopment, the nearby Iberville housing project has been slated for eventual demolition, which likely would coincide with the proposed expansion of the medical district. Of course, this path of redevelopment raises distributional

issues, since public housing and public health care facilities are slated for removal, threatening two major sites providing not only safety-net services but entire, historically entrenched social infrastructures for low-income residents.

Ultimately, the state's support for the new complex also depends on a second major planning effort currently underway for a federally supported health care system and insurance pilot project. Spearheaded by US Health and Human Services Secretary Michael Leavitt and Louisiana Department of Health and Hospitals (DHH) Secretary Fred Cerise, the directors of the pilot project have expressed high hopes that the future New Orleans health care system will serve as a model for the state and the nation. Leavitt has been particularly vocal, offering staff to assist in the planning phase and a willingness to accommodate the transition through a flexible application of federal Medicare and Medicaid rules and funds, provided that the new system dramatically breaks from the old to focus more on patients and less on institutions while achieving cost-savings in the long run (*Times Picayune* [New Orleans], 18 July 2006). On October 20th, the Health Care Redesign Collaborative released a concept paper for review by state legislature, the LRA, Leavitt's office, and the Centers for Medicare and Medicaid Services (CMS), each of which would play a role in funding the ambitious project. In spelling out a pilot project for Region 1 reform – eventually intended to expand statewide – the concept paper generally echoes the earlier LRA-sponsored Pricewaterhouse Coopers report, which criticizes the existing “two-tiered” system characterized by a shortage of beds in the public-sector and a surplus in the private-sector beds. Moreover, Leavitt, the LRA, and the BNOB plans all generally reflect a similar rhetoric for New Orleans health care as a more patient-centric system where the large institution model historically epitomized by Charity Hospital is replaced by a more decentralized, community-based primary and preventive care centers, which the Redesign

Collaborative calls a “medical homes” model (Louisiana Health Care Redesign Collaborative 2006). In the proposed system, the high cost of expanding insurance to low-income individuals who do not qualify for Medicaid (generally, those earning less than 200 percent of the Federal poverty level) is balanced by cost savings from access to a managed-care network of public and private “medical homes” and hospitals with more flexible application of Medicare and Medicaid coverage. In accordance with the dominant paradigm of public health practice, the new system will place additional emphasis on preventive care, health education, and public-private partnerships across a range of regional provider networks (including hospitals, public health units, and Federally Qualified Health Centers (FQHCs)) to ensure access to care.

However, at least two major challenges stand in the way of implementing such a bold agenda for reform. First, from newspaper editorials to Health Secretary Leavitt’s cautionary warnings against “individual and corporate interests” allowing the failing of implementation of fundamental systemic changes, many reform-minded individuals fear opposition from interests representing the old system with firmly entrenched power in the state legislature (*Daily Advertiser* [Lafayette], 21 July 2006). Many reformers attribute the system’s faults to the inefficiency and inertia of “Big” Charity – a sort of double entendre referring both to the size of Charity’s New Orleans high-rise building and to the resistance to reform of the massive Charity System, an institution dating back over 250 years and only lately run by LSUHSC. On the other hand, if the Charity System finally unravels and LSUHSC’s new facility emerges as a more specialty-driven hospital, failure to effectively extend coverage through the “medical homes” model could result in a permanent loss of the safety net for low-income health care. Additionally, if the pilot project fails to dissolve the “two-tiered” distinction, the state could struggle with paying down debts on the proposed facility.

Even before the current planning phase, the pilot project was scaled down from a statewide initiative to focus solely on the New Orleans region. As sketched out in the Redesign Collaborative concept paper, the pilot program for expanding insurance coverage to 80 percent of Region 1's 127,000 uninsured residents in the first five years will cost an estimated \$383 million – \$1 billion if the program expands statewide in the future. Michael Leavitt's office, however, has been vague regarding whether the federal level of commitment to regulatory flexibility will extend to include additional funding. On the other hand, the more decentralized vision for the future will likely dramatically alter the local model for health services employment. The "medical homes" model proposes a network of primary care centers geographically dispersed throughout the region, suggesting a decreased role for the traditional downtown medical district. Instead, neighborhood- and community-situated health units would deliver relatively more care and employ more workers, shifting the health care employment paradigm away from large institutions and toward smaller enterprises.

Workforce development provides a second major challenge, albeit one thus far receiving significantly less attention than related proposals for massive investments in physical health care infrastructure and insurance reform currently on the table. The Pricewaterhouse Coopers (2006, 98) report, probably the most extensive current study on the medical workforce, recommends a more even statewide distribution of medical residents according to population, which would reinforce the dearth of residency positions currently available in New Orleans' decimated GME infrastructure. Within the New Orleans Region, the placement of residents would decentralize as private hospitals and community-based primary care centers take on additional residency positions. For nurses, the report recommends more comprehensive career ladder programs with stronger incentives to graduate LPNs to RNs, a more skilled position in greater demand, as an

immediate opportunity to address existing workforce shortages (Pricewaterhouse Coopers 2006, 19, 98, 113). Fitzgerald (2006, 55-57) nominates such strategies as sound health and economic policy, but notes that in practice health care career ladder programs remain structurally hampered by characteristics of federal Medicare/Medicaid funding and by inadequate state investment in community colleges. Tulane HSC and LSUHSC leadership have voiced similar concerns with the structural inefficiencies built into the way hospitals and universities share federal funds, especially during the current phase post-Katrina upheaval. With the LRA's recent agreement to use \$38 million of the CDBG money for workforce development programs, there exists an opportunity to marry health care workforce programs in Allied Health fields and supporting occupations to the region's remodeled health care agenda.

On the whole, however, workforce development remains a major weakness of past Bio-Med initiatives, both in the field of health care and in more recent attempts to stimulate the biotechnology industry. Even in otherwise successful cases of biotechnology sectoral strategies, a gap in workforce programs can serve as a weak link.¹⁸ While the LRA's funding for statewide programs shows promise, its impact on New Orleans is far less clear than even the health care planning effort at the time of this writing. Workforce development, along with a lack of effective leadership in biotechnology initiatives, thus remains a proximate weakness in New Orleans' Bio-Med sectoral strategies.

¹⁸ Fitzgerald and Leigh nominate workforce development as the major shortcoming in New Haven's biosciences initiatives built around Yale University.

Conclusion: The Complex Process of Planning Economic Growth in a Recovering Environment

With recent forays into fostering biotechnology and biosciences within the New Orleans region laid out, several points give significant cause for skepticism regarding the potential for biotechnology to provide the answer for regional economic diversification. First, given the high degree of concentration in the biotechnology industry, it is unclear whether the industry will serve as a major economic project in most regions, especially in marginal areas like New Orleans. Even in the top tier of biotech regions, the industry has a relatively small impact on the overall regional economy (Cortright and Mayer 2002); and biomanufacturing, perhaps the segment of the industry most capable of generating basic employment for workers without an advanced level of education, remains even more concentrated (Fitzgerald 2006). On the other hand, as the industry continues to grow and to evolve, its changing spatial arrangements will likely allow additional regions to participate at a higher absolute level, even if the vast majority of investment remains relatively concentrated in a few regions. In this respect, New Orleans has many competitors; but building on existing initiatives, such as the BioInnovation Center, may allow New Orleans to capture marginal gains from the biotech industry's maturity process. Still, committing additional resources without more significant efforts to study and to coordinate an agenda on the local level remains a dubious prospect with uncertain results.

Second, numerous state and local governments have adopted biotechnology as a focus of economic development strategies in recent years. Like the cluster rhetoric through which biotechnology is often understood, faddism and the simple fact that nearly all significantly urbanized areas contain some component of a potential biotechnology cluster (e.g., research universities or medical institutions) likely account for some of the popularity. As research on innovative landscapes suggests, biotechnology firms depend critically on a rare assortment of

local conditions, a “competitive cluster” or an “innovative milieu,” and likely will not respond to traditional recruitment and retention programs, such as tax incentives and subsidies. Instead, state and local governments have adopted place-based and institutional approaches, such as science parks, biotechnology incubators, and commercialization programs for universities that most directly benefit extremely high-skilled workers. Even before Katrina, similar efforts in New Orleans were in many respects behind the curve set by many other peripheral biosciences locales, including smaller regions within the state. Additionally, such strategies demand a high rate of subsidy per directly created job (Fitzgerald and Leigh 2002, 64). As is the case in downtown New Orleans, physical investments are more driven by downtown redevelopment than by efforts to create an infrastructure for regional innovation. Thus, both the place-based and human components of biotechnology strategies often offer little direct benefit to those most in need. Workforce development and associates-degree and certificate training programs offer a possible answer to this shortcoming but usually receive much less attention and rely indirectly on the uncertain success of top-down efforts to foster commercialization suitable to generate demand for a sector-specific labor force. In many cases, biotech firms remain skeptical of workers with minimum-required levels of training, such as associates degree or certificate programs; and although several instances of programs tailored to meet biotech demand for labor have started to change this bias in certain regions, biotech jobs may simply end up being too much of a stretch for underserved groups (Fitzgerald 2006, 148). Even with successful commercialization, biotech firms characteristically operate through interregional linkages at least as much as through intraregional linkages. Thus, much of the direct, indirect, and induced economic impact from a successful strategy leaves the constituent locale.

Third, while biotechnology strategies have gathered momentum on the state level, to this point, the region has lacked a key leadership and advocacy structure, either in the form of a “role model” firm or through the efforts of an effective, locally oriented industry organization to facilitate networking and lobbying on the behalf of regional firms. Research has demonstrated that such structures, especially in the most recently emerging biotechnology centers, have served an important role in cluster formation (Walcott 1999; Walcott 2002; Huag and Ness 1993). In contrast, major state- and university-policies, like biotech incubators, have often followed rather than led the initial formation of biotech commercialization by small- to medium-sized enterprises in the best performing regions.

Finally, New Orleans has traditionally displayed a relatively weak local culture for innovative entrepreneurship, as demonstrated by relatively small receipts of private and federal sources of venture capital and a relatively late installation of state venture capital funds. Further, with Katrina wrecking havoc on any attempt to promote “quality of life” in New Orleans, the region is poorly positioned with respect to one of the main ingredients of an innovative environment. New Orleans’ primary strength – its medical and biosciences research institutions – does not, in itself, constitute a suitable basis for fostering an innovative, entrepreneurial cluster, even before accounting for institutional losses suffered from Katrina.

As the BRDP plan states, perhaps the most significant outcome from recent initiatives is primarily symbolic: “By investing a relatively small amount of money to implement the BRDP and its associated wet lab incubator facility, we can drive a stake into the ground and put up a sign that says ‘*Louisiana: Open for Business*’” (BDRP 2002, 18). Other recent documents, have warned against the perils of inaction, as if failing to facilitate local bioscience commercialization and to participate in the ongoing global evolution of the biotechnology industry would “kill the

goose that lays the golden egg” (BNOB Biosciences Workgroup 2005, 1; BNOB 2006, 45).

However, the globally footloose nature of the industry, still marked by the process of concentration into top regions, implies that, even if sectoral strategies and university enhancement policies can entice the goose to New Orleans, it may lay its egg elsewhere.

Although the BNOB Commission’s “Bio-Med” category is poorly defined and somewhat deceptively inclusive, this thesis has attempted to dig deeper into the conceptual merging of the existing health care industry with the biotechnology industry, a more attractive category for economic developers both with modest hopes to increase employment diversity and investment and with loftier ambitions to play midwife in the development of a high-tech cluster. While expecting biotechnology to provide massive direct economic impacts in the New Orleans region may be unrealistic, prior to Katrina, health care already provided the largest source of payroll expenditure and, after the tourism industry, the second largest source of employment (BNOB 2006, 30). Today, trailing only construction, the health care industry accounts for 32 percent of total occupational demand in the Katrina Recovery Region requiring two years of training or less (Brady 2006). Looking more toward the long term, the magnitude of reform slated for the regional health care system presents a significant opportunity to merge workforce development with public health policy goals, thus improving employment opportunities for underserved populations and advancing health care quality outcomes. Looking broadly at the Bio-Med industries, this thesis has advanced the notion that rebuilding the health care system might provide a more practical direction for sectoral strategies than fostering a biotechnology industry.

However, a complex political economy dominated by competing policy priorities and interests has shaped the New Orleans’ Bio-Med industries in recent years. In the current post-Katrina rebuilding phase, an exceptionally diverse range of recovery initiatives competes for

resources in an uncertain fiscal climate, with the balance of decision-making and funding power existing at the federal and state levels. At the focal point of this process, New Orleans has been characterized as a “nonregime” environment, lacking an understood agenda, depending on issue-based coalitions rather than more permanent governing arrangements, and ineffectively targeting resources in the absence of a scheme of cooperation (Burns and Thomas 2006). Although Hurricane Katrina placed unprecedented stresses onto a system poorly prepared to handle them, a recent slate of planning processes provides an opportunity to unify an agenda for change – or to further fragment and antagonize the decision-making process. The Bio-Med industries exist in an arena marked by enormous skepticism from all sides, owing mainly to the high stakes and high level of investment involved, but also by partially intersecting visions for change across policymaking groups with a stake in the industry, including economic development, health care, downtown development, and universities. Spread across various scales of governance, these segmented agendas also frequently diverge conceptually at the level of professional competencies and policy priorities. Greater cross-pollination and coordination of efforts among various policy and planning initiatives with implications for the Bio-Med industries not only could present a more unified front for the distribution of disaster funds but also could lead to alternative responses to ongoing challenges.

Investing in human capital to support the health care industry certainly appears to be a practical course of action, since health care occupations account for the largest, most established, and most in-demand component of the regional Bio-Med industries. Lending a broader context to this assertion, Markusen (2004) presents a case for occupational targeting in addition to industrial targeting, especially in contemporary economies where workers, firms, and industrial geographical arrangements offer declining levels of long-term commitment to localities. She

recommends targeting occupations that appear to be “(1) be highly skilled, (2) show growth potential, (3) cluster spatially, (4) cross-fertilize with other sectors, (5) encourage entrepreneurship, and (6) match the potential of the areas workforce” (Markusen 2004, 266). Health care occupations not only meet each of these criteria but also account for a massive share of the regional economy (68,664 jobs pre-Katrina) and the vast majority of employment in the Bio-Med sector (94.6 percent) (BNOB 2006, 30). Unlike manufacturing or high-tech industries, primary health care provides a stable source of inherently local demand, much of which is financed at the federal level, while specialty care may generate income from outside the region. Moreover, the industry has trended upward in recent decades. Between 1970 and 2001, health care consumption doubled to 14 percent of U.S. GDP; and this number is expected to rise to 17 percent by 2011 (DeVol and Koepp 2003, 1). Many of these jobs are attainable for lower-skilled workers. While graduate medical education is an important component of regional health care systems, several additional medical workforce components require significantly less training, including a variety of health care support occupations and allied health professions. Fitzgerald (2006, 57) highlights widespread shortages in Registered Nurses, nurse’s aids, and other health care paraprofessionals and emphasizes the conduciveness of these occupations to career ladders. However, despite successes in a few pilot projects, job ladder and training initiatives face a shortage of funding for relevant community college programs at the state level, even as federal policy (Medicare and Medicaid) structurally regulates that many of these high-stress, below-minimum wage occupations are governed simultaneously by high demand and “cost containment” guidelines (55-56).

In the Hurricane Katrina-affected area, however, the LRA has already set aside \$38 million that can be used for workforce training in the health care sector. If the Region 1 Health

Care Redesign Collaborative's recommendations go into effect, the "medical homes" network for delivering services will demand a decentralized staffing model for a wide range of health care occupations, the precise organization of which is unclear at this point; and the Collaborative's proposals for extending insurance coverage will likely increase the initial demand for a wide range of medical services, assuming that expanded networks of health care succeed in capturing a larger segment of the population. However, while asking for \$120 million for income guarantees and incentives for doctors, dentists, psychiatrists, RNs, and licensed professional staff, the concept paper makes little mention of workforce development for health care support occupations at the lower end of the spectrum (Louisiana Health Care Redesign Collaborative 2006).

As a preliminary framework, the concept paper illustrates that, in practice, health care policymakers typically engage workforce development and job creation (typically preoccupations of the economic development field) as a secondary considerations.¹⁹ With the exception of higher-end GME programs, demand has primarily determined considerations for the health care workforce. In contrast, supply-side approaches, such as occupational targeting and strategic career ladder programs for health professionals and support occupations, could begin to fill existing structural medical workforce gaps. As a result, a more workforce-oriented perspective could help to unify and mutually advance both roles of the Bio-Med industry: to staff a system for delivering health care services and to provide a source of jobs and economic growth. By this reasoning, investing in human capital would emerge as a primary concern for

¹⁹ For another example, LSUHSC has responded to the LRA and legislature's skepticism over the proposed new hospital in downtown New Orleans by adding claims of massive economic impacts to the hospital's envisioned role in the health care and graduate medical education systems, while arguably glossing over initial questions regarding the need for an expensive new hospital to serve a smaller post-Katrina region.

health care reform. For their part, economic developers and economic geographers have made little attempt to render the widely recognized contributions of health care to the regional economy explicit. Similarly, this thesis has focused mainly on biosciences and biotechnology and, more specifically, how economic development theory and practice gravitates to such high-tech industries; but health care occupations in some cases may provide a more realistic, more tangible alternative target for Bio-Med economic policies. Additional research should further articulate the regional structures and impacts of health care, placing the industry and its workforce in a more refined economic context than its relative absence from the literature would suggest.

In contrast, spatially concerned economic disciplines have more extensively considered biotechnology and other high-tech industries, but the precise workings of such clusters remain under-expressed. This literature somewhat understandably has paid relatively little attention to the trajectories of marginal areas like New Orleans. The radically unsettled landscape of post-Katrina New Orleans is certainly not an ideal laboratory for investigating the empirical mechanisms of cluster formation. Rather, this thesis has focused on the structural and discursive components of policy formation, particularly the institutions, political entities, and definitions that mediate the conceptualization of biotechnology and health care in sectoral strategies. In this respect, New Orleans serves as an apt window into the piecemeal mobilization of ambiguous cluster concepts, as well as the politically and economically constrained strategies that follow. Future research and policy should further attempt to unpack the assumed linkages internal and external to the diversely constituted Bio-Med category and should strive for more comprehensive, more closely aligned approaches to health and economic policies.

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