ESSENTIAL:

THE IMPACT OF THE HEALTHCARE AND LIFE SCIENCES SECTOR IN CENTRAL INDIANA

EXECUTIVE SUMMARY

August 2021

Produced for: BioCrossroads

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TECONOMY PARTNERS LLC

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Prologue

In Indiana, we see the benefits of having a strong healthcare and life sciences sector every day. It accounts for one in every ten jobs in the state, provides an annual economic impact of over $80 billion, and is present in the substantial assets spanning the corporate, university and philanthropic sectors. Over the past year we saw many of these healthcare and life sciences companies lead the way for our state, our nation, and beyond to help manage the response to a global pandemic which took the lives of so many. Whether it was Roche Diagnostics receiving a COVID-19 PCR diagnostic test approved under Emergency Use Authorization and on the market in a matter of weeks; Eli Lilly and Company's quick partnership to develop and secure Emergency Use Authorization for a monoclonal antibody treatment, in addition to their remarkable efforts to assist the state with testing; Catalent's scale-up to manufacture the COVID-19 vaccine for Moderna and Johnson & Johnson; Covance's acceleration of COVID-19 test processing capability; and our hospital systems moving from diagnosis to treatment and vaccinating patients, Indiana companies made a difference.

The infrastructure required to activate this response were the result of decades of investment including financial, talent, and time, by all members of the healthcare and life sciences sector. From investments in facilities, equipment, research, talent, and connections through BioCrossroads, Indiana's healthcare and life sciences sector has a substantial collective impact on the vitality of Indiana. In this report, TEConomy Partners, LLC. examined the influence of these investments on Central Indiana and how they help provide benefits to Indiana's other sectors including manufacturing, technology, and retail.

The report begins with a description of the functional impacts of the sector – those non-financial benefits to the community resulting from healthcare and life sciences. They include high quality healthcare services, the contribution to innovation and economic development, education and talent development, and overall improvement to societal well-being and quality of life. More traditional economic impact measures are described next, including total wages and job numbers and contribution to gross domestic product, production, sales, and tax revenues. These infrastructure investments have built an ecosystem and value chain that goes beyond traditional research and development. It also consists of manufacturing, distribution and logistics and all that is required in-between. A deeper discussion of the ecosystem's response to COVID-19 comes next. The final section provides a summary of the information presented and underscores the importance of continued investment in the sector.

This is an important and timely report. And certainly, it is appropriate here to thank those whose efforts have made it possible: Lilly Endowment Inc. and the Richard M. Fairbanks Foundation through generous grants to the CICP Foundation on behalf of BioCrossroads, provided essential funding; the many members of the healthcare and life sciences community, including manufacturing, transportation, and logistics; leaders at our major research universities and government agencies, who contributed information and participated in interviews; my colleagues Nora Doherty and Brian Stemme, who led and supported this project for BioCrossroads; and our consultants at TEConomy Partners, who know both Indiana and the innovation sector well and drew on their substantial expertise to provide a helpful and comprehensive study.

Indiana, the nation, and the world will move past COVID-19. As we continue to navigate through its effects, healthcare and life sciences will continue to play an important role. The investments that have been made, and that continue to be made, to support this sector enabled Indiana to respond to the challenge and will help ensure that Indiana's economy remains vital for years to come.

Sincerely,

Patricia A. Martin
President and CEO, BioCrossroads
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Executive Summary

A KEY ECONOMIC DRIVER

The healthcare and life sciences sector plays an essential role in driving the U.S. economy. As an advanced industry cluster with assured demand, robust growth prospects, and an array of employment opportunities, the opportunities in this space are critical to economic development in the 21st century. This is especially true for Central Indiana, where healthcare and life sciences represent a regional signature[1] and a sophisticated innovation ecosystem. With the healthcare and life sciences sector seeing both opportunities and challenges on the horizon, it is important to understand, protect, leverage, and help advance the world-class assets that comprise this ecosystem.

As a hub for academic medicine and health sciences research and higher education, the Central Indiana region benefits from assets such as the Indiana University (IU) School of Medicine (the largest in the U.S. as measured by number of students), IUPUI, and IU Health, a provider of advanced specialty clinical care and general clinical services. Not only is the academic and community health cluster a major employer for the region, but it offers residents access to high-quality healthcare, which plays an important role in human health, and economic development.

Healthcare and life sciences represent a regional signature for Central Indiana's economy and quality of life

- **IU School of Medicine, IU Health and specialty clinical care facilities provide access to quality healthcare** and a destination healthcare center for complex cases.
- **The healthcare sector itself is a key employer** in Indianapolis, providing an extremely wide range of secure job opportunities.
- **The life sciences industry is similarly diverse in its employment opportunities,** creating demand for work across R&D, manufacturing, warehousing, distribution, and all the business functions that support the value chain.
- **Critical location for medical product logistics** due to advantageous geography and access to a leading FedEx hub.

Several of the world's largest and most innovative life sciences companies also call the region home, such as Eli Lilly and Company, the North American headquarters of Roche Diagnostics, Cook Medical, Catalent Biologics, Covance Labs, and many others. As noted by TEConomy/BIO,[2] the Indianapolis metro area ranks second-highest in the nation among large metro areas for its employment concentration in drugs and pharmaceuticals (with employment specialization at levels five times the national average). Notably, the region is a key hub in the development, testing, production, and distribution of biopharmaceuticals, diagnostics, and advanced medical devices. Its advantageous geography and access to a leading FedEx hub also makes Central Indiana a critical location for medical product logistics, providing the ability to ship urgent and time-sensitive medical products (such as radiopharmaceuticals and vaccines) to market quickly and efficiently.

1 TEConomy defines a "regional signature" industry as one that has a significant base of R&D and innovation activity, and which demonstrates a comparative leadership position by virtue of having a specialized location quotient (a measure of comparative concentration in an industry versus national normative levels).

2 TEConomy/BIO, "The Bioscience Economy: Propelling Life-Saving Treatments, Supporting State & Local Communities," 2020. The Biotechnology Innovation Organization (BIO) is the world's largest biotech trade association.

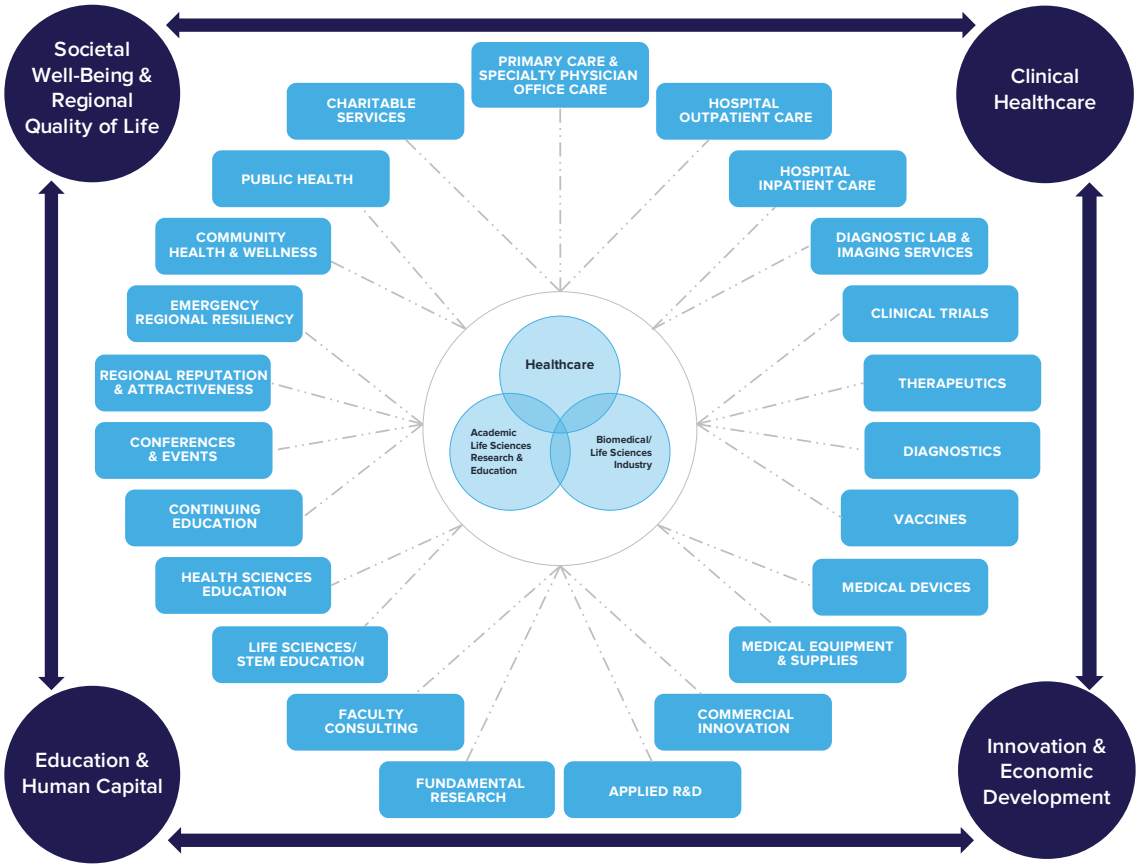
A TIME OF CHANGE

While the healthcare and life sciences sector remains vital to the success of Central Indiana and the nation at large, it is not immune to the effects of disruptive technologies and forces of change. New advancements in fields like artificial intelligence, genomics, gene editing, regenerative medicine, synthetic biology, advanced health data analytics, personalized medicine, and other emerging fields of opportunity are changing the sector's landscape. As such, it is particularly important for Central Indiana to take stock of what it has, and to build a robust understanding of the economic and societal impact of this key industry cluster. This study aims to contribute to that understanding.

FUNCTIONAL IMPACTS

This advanced industry generates a wide range of beneficial functional impacts[3], in part due to the diversity of organizations engaged in the sector (universities, hospital systems, manufacturing industries, etc.). As shown in Figure ES-1, these impacts ultimately converge around four primary domains: Clinical Healthcare, Societal Well-Being and Regional Quality of Life, Education and Human Capital, and Innovation and Economic Development.

Figure ES-1: The Functional Impacts of the Healthcare and Life Sciences Sector



Source: TEConomy Partners, LLC.

The first functional impact area relates to the provision of clinical healthcare. High-quality healthcare services positively contribute to quality of life across a variety of settings, including family practice physicians' offices; urgent care clinics; specialty clinical practices; outpatient ambulatory care practices; acute care hospitals; long-term care and rehabilitation facilities, and hospice centers. Supporting these frontline providers is a large and diverse network of supporting services in laboratory services, patient transportation, and all the supplies and ancillary services that support the clinical care ecosystem.

Second, the cluster contributes to innovation and economic development. The healthcare and life sciences R&D ecosystem creates products and services needed and valued by society which in turn generate employment, economic output, exports, and public sector revenues. Across sectors such as biopharmaceuticals, advanced diagnostics, medical devices, and medical

3 A functional impact is defined as a positive impact generated for an economy, society, or for individuals through the mission-focused activities of an organization, institution, industry, or specific project.

equipment, Central Indiana's innovation ecosystem encompasses a full spectrum of research, from fundamental research into biological processes, through applied and translational sciences, and onwards into clinical research and clinical trials activities. Healthcare and life sciences companies also make large-scale infrastructure investments to develop and support the specialized work necessary for a highly regulated industry. These infrastructure investments also provide benefits for Indiana's other sectors including manufacturing, technology, and retail.

A third functional impact area relates to education and human capital development. Central Indiana is advancing basic and applied knowledge and building the know-how and skills necessary for a high productivity healthcare and life sciences workforce. Home to IU School of Medicine, with the nation's largest enrollment, Indianapolis is a principal hub for the education of physicians and an intensive location for the education of nurses and other clinical and allied health professionals. The region's world-class colleges, universities, and academic health systems also help develop talent in life sciences, biomedical engineering, and other important disciplines.

Lastly, the cluster helps improve societal well-being and enhance quality of life. The COVID-19 pandemic highlighted the importance of a robust healthcare and life sciences ecosystem to regional resilience in the face of a fast-moving health crises. Central Indiana's healthcare and life sciences sector helps secure public health and build equitable, diverse, and resilient communities with robust livability, quality-of-place, and quality-of-life, across the entire lifespan, from conception through to elder-care care. Having quality care matters economically too, because those regions with a world-class clinical care system have a competitive advantage in attracting and retaining people and employers.

ECONOMIC IMPACTS

The presence and operations of the wide-ranging healthcare and life sciences ecosystem in Central Indiana provides a broad range of functional benefits for individuals and society. The operations of these diverse organizations and businesses within this ecosystem also generate large-scale economic impacts within the region. Consisting of an intertwined and collaborative set of actors, the sector includes industry leaders to major healthcare systems to a school of medicine and biomedical-related academic research occurring within the region. While many of these actors individually have well-known names such as Eli Lilly, Roche, and IU Health, what sets Central Indiana apart is that the whole is truly greater than the sum of its parts, driving significant impacts through the regional economy.[4]

Three components make up the Central Indiana healthcare and life sciences sector—industry, healthcare, and academe (higher education). Each component plays a different role in the region, but combined account for 164,144 employees (Table ES-1 and Appendix).

Table ES-1: Central Indiana's Healthcare and Life Sciences Components and Subsectors, 2019

Healthcare and Life Sciences Subsectors	Employment
Industry	28,711
Biomedical Manufacturing	22,506
Pharmaceutical Manufacturing	16,380
Medical Instruments, Devices, and Supplies Manufacturing	6,126
Biomedical Distribution	4,036
Biomedical Research & Development (Industry, NEC)	2,169
Healthcare	129,793
Hospitals	65,181
Private Hospitals	51,415
Public/State/Local Hospitals	10,565
Federal Hospitals (e.g., VA)	3,200
Physician and Other Health Practitioner Offices	43,524
Ambulatory Healthcare Services	11,820
Outpatient Care Centers	5,935
Medical Testing	3,333
Academic School of Medicine and Biomedical Research[5]	5,640
Total, Central Indiana Healthcare and Life Sciences	**164,144**

Note: "NEC" = Not Elsewhere Classified.
Source: TEConomy analysis of 2019 U.S. Bureau of Labor Statistics QCEW Data enhanced by IMPLAN.

4 For the purposes of this examination the Central Indiana region includes the Indianapolis MSA while also incorporating the complete corridor between Indiana University and Purdue University. This 14-County region includes the following counties: Boone, Brown, Hamilton, Hancock, Hendricks, Johnson, Madison, Marion, Monroe, Montgomery, Morgan, Putnam, Shelby, and Tippecanoe.

5 Estimate based upon IU School of Medicine fact sheet and Academic R&D in biomedical-related disciplines as reported in the National Science Foundation's 2019 Higher Education Research and Development (HERD) Survey.

The economic activity associated with Central Indiana's healthcare and life sciences sector is generated by purchases of goods and services from other businesses and from wages paid to workers, who in turn purchase other goods and services from other local companies. These successive cycles of revenues and purchases are called multiplier effects.

The results of the full economic impact analysis, shown in Table ES-2, capture the 164,144 direct healthcare and life sciences jobs within the Central Indiana economy, and how the spending of the sector's institutions and actors ripple through the regional economy. The more than $33 billion in value added to the regional economy appears as the direct effect in Table ES-2. Combined, the components and subsectors of the healthcare and life sciences sector are estimated to have generated direct output of nearly $57 billion in 2019. Importantly, considering the number of public and non-profit institutions captured within, the sector generates more than $1 billion in state and local tax revenues annually (including taxes of all types).

Table ES-2: Economic Impact of Central Indiana's Healthcare and Life Sciences Sector, 2019

Impact Type	Employment	Labor Income ($M)	Value Added ($M)	Output ($M)	State & Local Tax Revenues ($M)	Federal Tax Revenues ($M)
Direct Effect	164,144	$16,336.2	$33,203.1	$56,758.7	$1,003.1	$3,389.1
Indirect Effect	83,583	$5,580.7	$8,234.3	$14,486.3	$487.6	$999.5
Induced Effect	83,836	$3,961.4	$7,653.5	$12,724.7	$729.7	$780.1
Total Impact	331,563	$25,878.3	$49,090.8	$83,969.6	$2,220.4	$5,168.7
Multiplier	2.02	1.58	1.48	1.48		

Source: TEConomy analysis of 2019 Central Indiana Regional IMPLAN impact model.

From a total impact perspective, **the Central Indiana healthcare and life sciences sector generates and supports nearly $84 billion in total economic output—every $1 of direct output generates an additional $0.48 within the regional economy.** This economic impact also generates and supports additional employment in the region. A total of **331,563 Central Indiana jobs are supported by the sector** with the non-direct additional employment almost equally split between indirect (supplier) and induced jobs. Every job within the Central Indiana healthcare and life sciences sector supports 1.02 additional jobs in the regional economy.

While these numbers seem impressive at face value, the importance of the Central Indiana healthcare and life sciences sector to the regional economy is more fully appreciated through an analysis of its share of regional economic impact metrics.

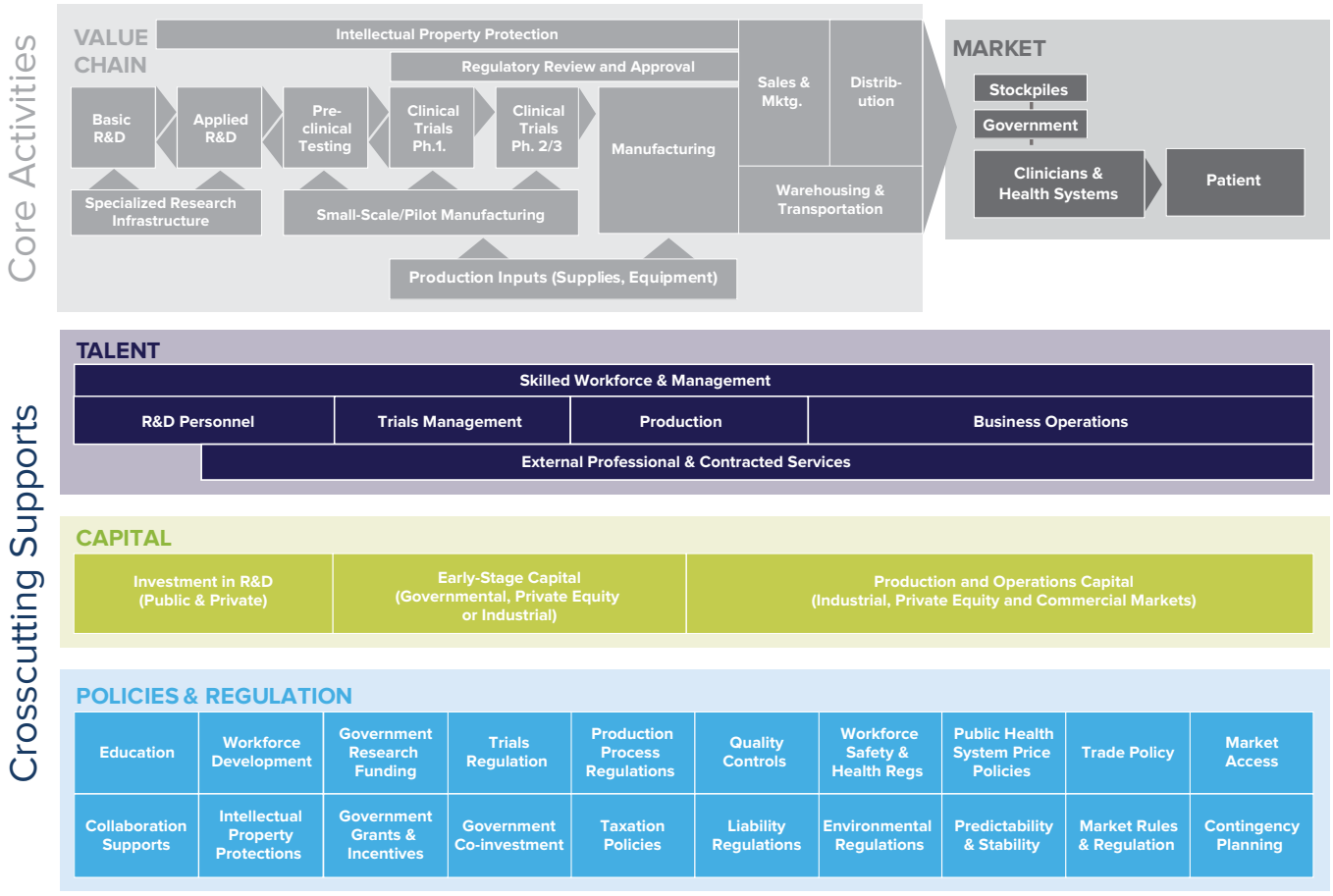
From a direct impact perspective, the healthcare and life sciences sector accounts for 10.6% of regional employment, 16.5% of regional labor income, 19.6% of regional total value added, and 18.7% of total regional output. By comparison, the entire Central Indiana manufacturing sector accounts for 7.9% of the region's employment, 11.5% of the region's labor income, 17.3% of the region's value added, and 25% of the region's total output.

More importantly, the Central Indiana healthcare and life sciences sector supports, through its total economic impacts, at least 21% of the regional economy across four major economic impact metrics: employment (21.4% of the Central Indiana Regional total), labor income (26.1%), total value added (28.9%), and output (27.7%).

IMPACTS ARE GENERATED AND SUSTAINED BY A HOLISTIC HEALTHCARE AND LIFE SCIENCES ECOSYSTEM

Based on a formal evaluation of lessons learned across 13 life sciences ecosystems across the globe during the COVID-19 pandemic, a recent project for Pfizer, Inc. studied the structure and characteristics of a holistic life sciences ecosystem.[6] This ecosystem framework can be used as a structure for examining the completeness of the ecosystem that has been developed in Central Indiana for the healthcare and life sciences ecosystem (Figure ES-2).

Figure ES-2: The Healthcare and Life Sciences Ecosystem



Source: TEConomy Partners, LLC. for Pfizer, Inc

The framework is divided into two principal components. First, there are the core activities of the central value chain that conducts research and development, and tests, produces, and distributes healthcare and life sciences products and services. Second, there are crosscutting ecosystem supports, which are divided into three core areas: talent, capital, and policies/regulations. Evident in this framework is the complexity of a full ecosystem. There are a great many individual elements that have to combine to provide a region with a holistic presence across the ecosystem. As seen in Table ES-3, Central Indiana is well-positioned in terms of having particularly complete coverage of key ecosystem elements.

6 Simon Tripp, David Hochman, and Mitch Horowitz. 2021. "*Response and Resilience: Lessons Learned from Global Life Sciences Ecosystems in the COVID-19 Pandemic.*" TEConomy Partners for Pfizer, Inc. Accessible online at: https://www.teconomypartners.com/wp-content/uploads/2020/11/Response-and-Resilience-Lessons-Learned-from-Life-Sciences-Ecosystems-and-COVID-19.pdf.

Table ES-3: The Healthcare and Life Sciences Ecosystem in Central Indiana – Key Metrics

CORE ACTIVITIES

Academic Healthcare and Life Sciences Research	Commercial Healthcare and Life Sciences R&D	Clinical Testing and Clinical Trials	Manufacturing	Distribution
• $604.5 million in federal R&D funding to Central Indiana higher education institutions in healthcare and life sciences. • IU School of Medicine, 95% growth in NIH funding since FY2015.	• Estimated $8.6 billion in commercial healthcare and life sciences R&D spending by regional companies in 2020.	• 2,397 ongoing clinical trials in Indiana.	• 22,506 manufacturing jobs in healthcare and life sciences products in Central Indiana (18.3% of regional manufacturing employment).	• 4,036 personnel employed in biomedical distribution in the region.

TALENT

Biosciences Graduates	Health and Clinical Sciences Graduates	Medical Students	Total Regional Employment in Healthcare and Life Sciences Sectors
• 1,617 graduates in 2020 from regional institutions with degrees in biological and biomedical sciences.	• 10,331 graduates in 2020 with an Associate's degree or higher in health and clinical sciences fields.	• 365 enrolled medical students in the class of 2024 (288 in-state students). • Largest medical school in the U.S. in total enrollment.	• 164,144 total direct jobs in Central Indiana in the healthcare and life sciences cluster.

CAPITAL

SBIR/STTR	Venture Capital	Public Companies (Valuation)	Major Capital Projects
• In 2020, there were 26 awards, within 21 companies in Indiana. Total of $12.6 million.	• In 2020, Indiana life sciences companies raised $262 million in VC.	• 12 public life sciences companies with Dec. 2020 market cap of $297.6 billion.	• Average of $455 million in major capital projects each year for five years. • 2.94 million square feet of construction for 2019-2023 5-year period. Combined capital project spending of $2.27 billion.

Source: TEConomy Partners' analysis and assembled from a variety of sources.

COMING TOGETHER TO ADDRESS COVID-19

The way in which key regional stakeholders across the public sector, industry, healthcare, and academe came together to collaborate and address the COVID-19 Pandemic in Central Indiana is particularly striking. In the face of a relatively uncoordinated and limited federal response, states and regions had to innovate and stand-up their own pandemic response. Central Indiana's ability to leverage its ecosystem and rise to the challenge is important to document and communicate.

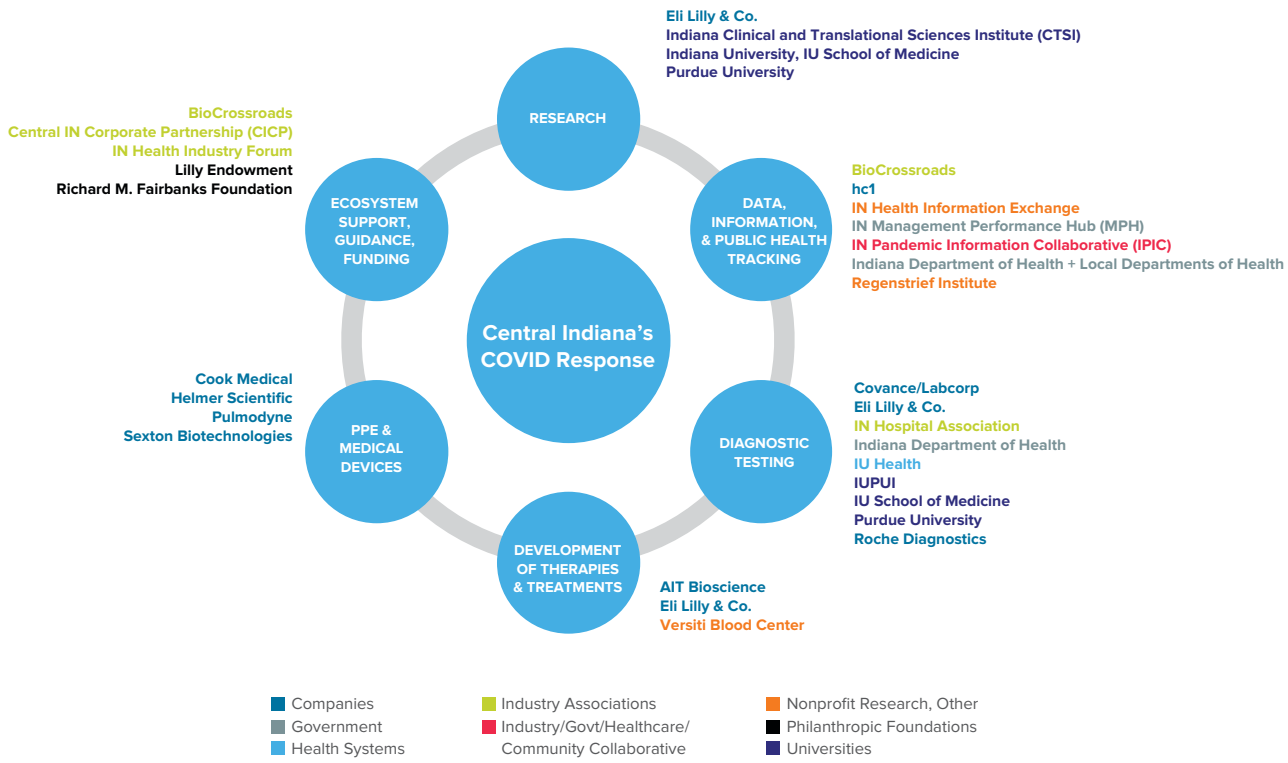
Even though Central Indiana's healthcare and life sciences ecosystem is extraordinarily complex, with many parts and moving pieces, it benefits from having in place a collaborative organization under the Central Indiana Corporate Partnership (CICP) and BioCrossroads—a meeting ground for those concerned with the successful development and operation of the ecosystem. Because this "connective tissue" already existed, the region was better able to be quick on its feet in reacting to the emerging pandemic.

Meeting weekly through a series of video-conference meetings, participants from state and local governments, universities and hospital systems, and leading private sector businesses helped coordinate a strategic approach that could leverage the ecosystem and help address the crisis. Figure ES-3 shows some of the key categories of assets that were drawn-upon in developing a coordinated response to COVID-19 in Central Indiana, and the individual organizations that stepped forward to participate in work to:

- Research the virus and biomedical approaches to diagnosing cases, combatting its transmission, and treating infections.
- Conduct data analytics, information science, and public health tracking to monitor the spread of the virus and direct resources to hotspots and points of vulnerability.
- Develop and procure diagnostic tests and provide population testing services.
- Develop novel therapeutics to combat infection, treat life-threatening symptoms, and support patient recovery.
- Rapidly improve supply and access to personal protective equipment (PPE) and important therapeutic medical equipment, such as respirators.
- Maintain business operations and protect critical workers throughout the pandemic to mitigate negative economic and social impacts.

The breadth of the healthcare and life sciences ecosystem and coordinated response to the pandemic in Indiana is illustrated by the varied actors and pandemic response categories in Figure ES-3 that span the corporate sector, government, academe, industry associations, non-profit research institutions, and philanthropy.

Figure ES-3: The Mobilization of Healthcare and Life Sciences Assets in Central Indiana to Mitigate the Negative Consequences of the COVID-19 Pandemic



Source: BioCrossroads and TEConomy Partners, LLC.

The leadership and connective tissue represented by CICP, and its affiliated cluster organizations, played an important role in helping the healthcare and life sciences ecosystem, and a broader set of community organizations, respond to the pandemic. CICP quickly mobilized and began facilitating bi-weekly teleconferences for its board members in early March 2020, offering a platform for public and private sector state leaders to coordinate efforts, receive updates, and stay informed. Outcomes and activities generated by these forums included rapid scale-up of COVID-19 testing capacities and locations throughout the state; retooling manufacturing capabilities to produce PPE for frontline healthcare professionals; developing "return-to-work playbooks" for the manufacturing, logistics and warehousing, office, and customer-facing settings; and coordinating letters of support for Governor Holcomb and Indianapolis Mayor Hogsett for mandating masks in public.[7]

CICP and BioCrossroads were able to leverage world-class talent in Indiana contained within the corporate, healthcare, academic, and public health communities to coordinate approaches to challenges as they arose in the pandemic. One early

7 Central Indiana Corporate Partnership (CICP) 2020 Annual Report.

example of this collaborative approach's effectiveness was early work to identify Indiana's resources for PCR[8] and other pieces of key scientific equipment that could pivot to applications in enabling diagnostic testing capacity to scale. Many of the techniques used are ubiquitous across biosciences (i.e., not only used in human biomedical applications, but also for basic biological sciences, veterinary medicine, agricultural research, etc.). As such, equipment, and the skilled personnel to operate the equipment existed in many locations in Indiana that were not part of the usual human diagnostics lab ecosystem. By identifying these resources and coordinating their coming-together in a collaborative consortium of sites, Indiana was able to significantly surge its capacity to conduct testing for COVID-19.

Taken together, Central Indiana's collaborative and well-coordinated response to the COVID-19 pandemic was especially impressive due to its effectiveness at mitigating the effects of the pandemic. Such a rapid and effective mobilization is representative of the robust ecosystem that has been built in the region and would not have been possible without the significant, long-term investments made over many years, if not decades. The public-private coordination in a high-functioning healthcare and life sciences ecosystem enabled Indiana to protect and inform its citizens throughout the pandemic.

CONCLUSIONS

The findings presented herein demonstrate that healthcare and life sciences represent a powerful economic engine for Central Indiana, playing a central role in providing economic and social resilience for the region on an ongoing basis and during public health emergencies. Central Indiana benefits greatly from the long-term investments that have been made by the private and public sectors in creating a complete healthcare and life sciences ecosystem—a complete range of activity from basic and translational research, through each step in the value-added development and production of products, technologies, and services, onwards into distribution and their use in the marketplace. The operations of this value-chain in Central Indiana are well supported by talent development programs and higher education programs that supply the well-educated and skilled talent needed to fill demands across the sector. Similarly, the region is attracting the capital resources needed to develop, scale, and grow the healthcare and life sciences enterprise.

The sector is expected to continue to grow, with projections noted herein for 27,000 jobs to be added in the forthcoming decade based on observable trends. This growth, however, could be higher if the ecosystem positively responds to forces of change and the opportunities presented for growth in healthcare products and services, especially those rooted in new technologies in genomics, gene editing, regenerative medicine, synthetic biology, advanced health data analytics, personalized medicine, and other emerging fields of opportunity. Ongoing investment will be needed, and attention paid, to sustaining and optimizing ecosystem conditions to continue to allow the sector to thrive.

Ultimately, it is clear that past and future investments in the infrastructure and talent that advance Indiana's life sciences and healthcare capacity represent a fundamental good for Indiana – enhancing the quality of life for Hoosiers; boosting the regional economy; making critical infrastructure investments that benefit multiple sectors including manufacturing, technology, and retail; and providing a proactive means of response in the face of public health emergencies.

8 PCR is the abbreviation for polymerase chain reaction and represents a fast technique for amplification (copying) of small segments of DNA. This amplification produces samples of DNA large enough for analysis in laboratory diagnostic processes.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