

6-6-2022

Disrupting Innovation

Richey Piiparinen

Cleveland State University, r.piiparinen@csuohio.edu

Joshua Valdez

Valdis Krebs

Jim Russell

Follow this and additional works at: https://engagedscholarship.csuohio.edu/urban_facpub


How does access to this work benefit you? Let us know!

Repository Citation

Piiparinen, Richey; Valdez, Joshua; Krebs, Valdis; and Russell, Jim, "Disrupting Innovation" (2022). *All Maxine Goodman Levin School of Urban Affairs Publications*. 0 1 2 3 1771.

https://engagedscholarship.csuohio.edu/urban_facpub/1771

This Report is brought to you for free and open access by the Maxine Goodman Levin School of Urban Affairs at EngagedScholarship@CSU. It has been accepted for inclusion in All Maxine Goodman Levin School of Urban Affairs Publications by an authorized administrator of EngagedScholarship@CSU. For more information, please contact library.es@csuohio.edu.

An aerial photograph of a park with a winding path, trees, and a building in the background. The image is used as a background for the book cover.

DIS-

Reimagining innovation,
the healthcare industry,
and health outcomes in Cleveland

INNO-

Richey Piiparinen,
Joshua Valdez,
Valdis Krebs,
and Jim Russell

RUPTING

VATION

Research and writing:

Richey Piiparinen is director of urban theory & analytics at the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. Joshua Valdez and Jim Russell are principals at Rust Belt Analytica. Valdis Krebs is principal at Orgnet.

Graphic design:

Agnes Studio

Images:

Courtesy of the Michael Schwartz Library Special Collections, Cleveland State University: ClevelandMemory.org, except where noted.

Commissioned by:

Cleveland Foundation

Copyright © 2022 Richey Piiparinen
All rights reserved.



above New clinic building at Cleveland Clinic at 2020 E. 93rd Street, circa 1948
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

front cover Garfield Park Boating
Image: courtesy of The Bowden Postcard Collection Online c/o Miami University Libraries - Digital Collections

Euclid Avenue, Looking West, Cleveland, Ohio, 1900-1929
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

Reimagining innovation,
the healthcare industry,
and health outcomes in Cleveland

Richey Piiparinen,
Joshua Valdez,
Valdis Krebs,
and Jim Russell



Executive Summary

This analysis creates a coherent conceptual framework for inclusive development, one of the first of its kind. In doing so, it reimagines innovation with community impact embedded at the forefront of thought. The aim is in direct lineage of Norman Krumholz's equity planning that captured the profession's imagination. Except, here, it would be more aptly described as "equity economic development."

The analysis uses novel statistical techniques, particularly natural language processing and social network analysis, to more precisely answer questions that Cleveland has been trying to answer for some time. Like what are the region's R&D assets that differentiate it from other cities? Who are the key researchers doing that work? How could these innovation-inducing assets be fostered by precision migration and convention strategies via the likes of Global Cleveland and Destination Cleveland? Most crucially: Do any of these regional assets align with neighborhood needs, in effect creating a feedback loop between economic and community development as opposed to the parallel, diverging, paths these sectors are currently on?

The short answer is "yes." A longer answer can be found in the pages that follow. It's enough now to say population health lies at the nexus of the opportunities and challenges that Cleveland faces in this brave new world going forward. The economy is inseparable from health. Without health, prosperity isn't possible. It's an appropriate time to "disrupt," or fundamentally reimagine, innovation, the healthcare industry, and health outcomes in Cleveland. The endgame, here, is not yet another economic development policy with well-being as a hoped-for byproduct. The endgame is better

health in Cleveland. In fact, better population health is an economic development policy, if not the only economic development policy that's needed in this time and place.

A society that functions flows into the physical and mental welfare of its citizens, which, in turn, feeds back into the functioning of society.

Table of Contents

Background	6
Act I: Toward Creative Reconstruction	8
Act II: Becoming Silicon "X"	10
Act III: Efficiently Insufficient	18
Act IV: Where's the Well-Being?	22
Act V: Intentional Innovation	28
Act VI: Hey Siri, What Does Cleveland Research and Develop?	32
Act VII: The Takeaway	40
Appendix	42
Index	44

“Innovation distinguishes between a leader and a follower.”

—Steve Jobs

Back-ground

In March of 2020, Jobs Ohio, the State of Ohio’s economic development agency, announced a partnership with the University of Cincinnati and Cincinnati Children’s Hospital Medical Center that would bring \$100 million of investment in the creation of the “Cincinnati Innovation District,” designed “to serve as a ‘blueprint’ for the state and ensure Cincinnati becomes a magnet for talent that attracts Fortune 500, mid-size and developing start-up companies.”ⁱ

In January 2021, the State of Ohio announced the creation of the “Cleveland Innovation District.”ⁱⁱⁱ It’s a multi-million-dollar effort. Planning among the region’s five anchor institutions has been ongoing, and while the Cleveland Innovation District has the potential to be a transformational endeavor, that’s only if local leaders can get it right. Getting it right entails describing what exactly innovation

is when it comes to economic development, coupled with an articulation of how innovation can be spurred a la “a district.” The most crucial issue, however, is figuring out what Cleveland should be innovating in and why. The fruits of innovation must have an economic *and* societal effect, as opposed to what technological advance has increasingly produced: a distending divide between having and not.

The most crucial issue, however, is figuring out what Cleveland should be innovating in and why.



Mt. Sinai (Medical Center) construction, 1973

Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

Act I:

The shepherds of creative destruction are inventors and entrepreneurs who – while motivated by profit – are also said to be driven by the collective good.

Now there is Zoom. The shepherds of creative destruction are inventors and entrepreneurs who — while motivated by profit — are also said to be driven by the collective good.^{iv} After all, the lifeblood of innovation is to find a better way — or to make what was harder easier, or what was scarce more abundant.

The agricultural revolution birthed a bloom in crop production, evolving the concept of “horsepower” so that it can substitute for, well, horse power. The industrial revolution made the limits of manpower more limitless by replicating it with combustion, pistons, and gears. The software revolution created a surplus of memory, unleashing information into our laptops and handheld devices that don’t forget with time.

But progress doesn’t stop. Today, innovation is less about access to information than it is making sense of it. It’s about knowledge. In fact, we have so much information that we are drowning in it, leaving us less informed, or worse: misinformed; or worse yet: disinformed, the latter defined by Oxford Languages as false information “intended to mislead.”^v The crux of the matter is that while information is abundant, our ability to comb through it isn’t. The human attention span is limited. Explained Microsoft CEO Satya Nadella, “Data is plentiful. Attention is scarce, and we’ll never get more of it.”^{vi}

Enter artificial intelligence (AI). The AI revolution is making the scarcity of human attention less so via the advance of cognitive computing. It’s the next “general purpose technology”^{vii} to change the course of events, unleashing a boom in our ability to find a signal in the noise. As revolutions go, it is just getting started. “[W]hile we’ve seen the AI sun, we have yet to see it truly shine,” writes Craig S. Smith in *The New York Times*.^{viii} “Researchers liken the current state of the technology to cellphones of the 1990s: useful, but crude and cumbersome.”

One of the most famous concepts in economic development is “creative destruction,”ⁱⁱⁱ coined by economist Joseph Schumpeter. Creative destruction is the process wherein new technologies make the older way of doing things obsolete. There was the horse and buggy, for example, and then there were cars.



Metropolitan General Hospital construction, circa 1962
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

Toward Creative Reconstruction

As the AI revolution inevitably unfolds, it will have a rippling effect across industries, firms, and products, not to mention the cities that make up the economic geography of those market entities. The Clevelands and Pittsburghs were kings when the steam engine and electricity changed the game. But then the Rust Belt lost its global relevance at the dawn of the Digital Age, and it’s still fighting to claw it back. That’s because economic evolution is not played out evenly across space. As creative destruction happens, some cities win, most lose. Some neighborhoods win, most lose. Some workers win, more lose.

Along the way, the American landscape has become dotted by these divergent outcomes, architected as aesthetics of ruins or glass towers. Of high-tech labs or plasma banks. Of dwellings for the knowledge worker or sometimes-homes for the service worker. As embedded in the concept social determinants of well-being^{ix}, it is but a hop, skip, and a jump away from a societal landscape to an individual’s bodyscape. Think lead poisoning while living in a lead-hazardous house. Or traumatization from street-level violence. **Simply, a society that functions flows into the physical and mental welfare of its citizens, which, in turn, feeds back into the functioning of society. A society that doesn’t, doesn’t.**

The gist of this analysis is to examine to what extent technological innovation has evolved economies and, in doing so, engendered societies that are functional or dysfunctional, with the ultimate question hovering on the horizon asking: “Does innovation itself need disrupting?” This brings to mind Facebook Founder Mark Zuckerberg’s famous motto in the early days of the social network start-up to “move fast and break things.” As detailed in the bestseller *Move Fast and Break Things: How Facebook, Google, and Amazon Cornered Culture and Undermined Democracy*^x we can unequivocally say, “mission accomplished.” Creative destruction has moved fast, and things have most definitely broke.^{xi} Today’s call to action is to not so much move abruptly as deliberately so that we can begin to get creative with America’s reconstruction.

Act II:

While per capita income can tell us about a region's average prosperity, it doesn't tell us about its distribution.

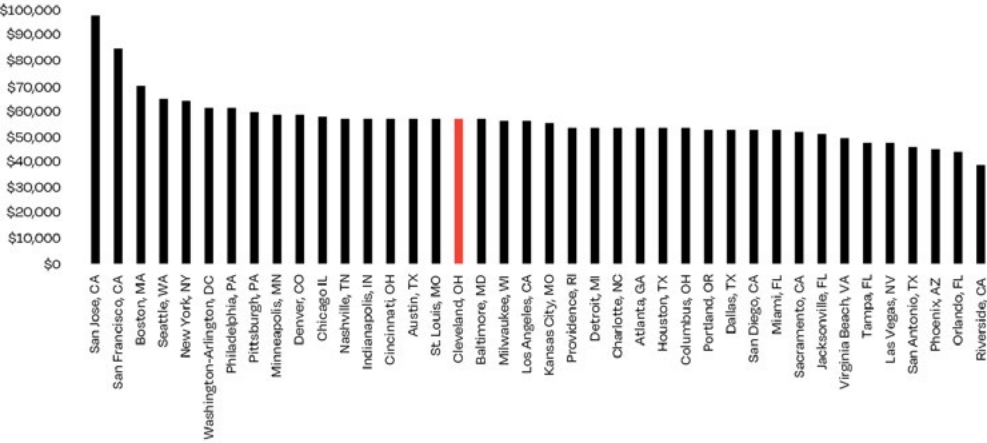
Whether a regional economy is on the right or wrong side of innovation can be measured by various statistics. For the sake of brevity, we focus on two statistics: real per capita income, or the average income of a resident adjusted for cost of living and inflation; and industry mix, or the regional share of economic output by industry.^{xiii}

These two stats are intertwined. The more prosperous a region, the more productive it is. The more productive a region is, the more technologically advanced it is.

According to the Bureau of Economic Analysis (BEA), the Cleveland metropolitan statistical area (MSA) has a real per capita income of \$57,115, ranking the region 45th out of 384 metros. Among the largest 40 metros, Cleveland ranks 17th (See Figure 1). Note that the three most prosperous big-city metros include Silicon Valley's San Jose, CA (\$97,914), San Francisco, CA (\$85,408), and Boston, MA (\$70,207). These regions are considered America's gold standard when it comes to innovation and economic development.

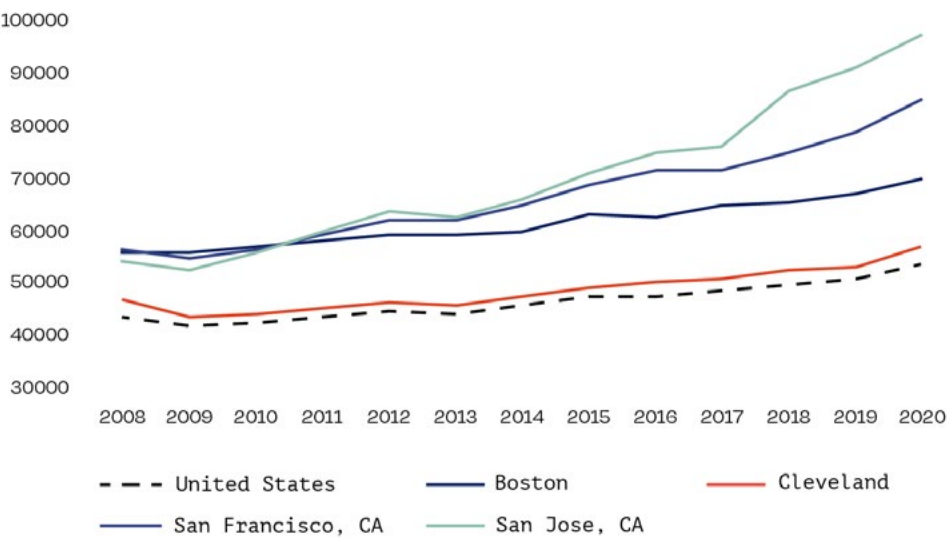
One is pulling away. In 2008, Boston, San Francisco, and San Jose, CA were clustered in terms of real per capita income. By 2020, San Jose has taken off. Lagging is Cleveland, whose trends mirror the United States as a whole.

Figure 1 Real Per Capita Income (in 2012\$) for Largest 40 Metros. Source: BEA, 2020.



Becoming Silicon "X"

Figure 2: Real Per Capita Income (in 2012\$). Source: BEA, 2020

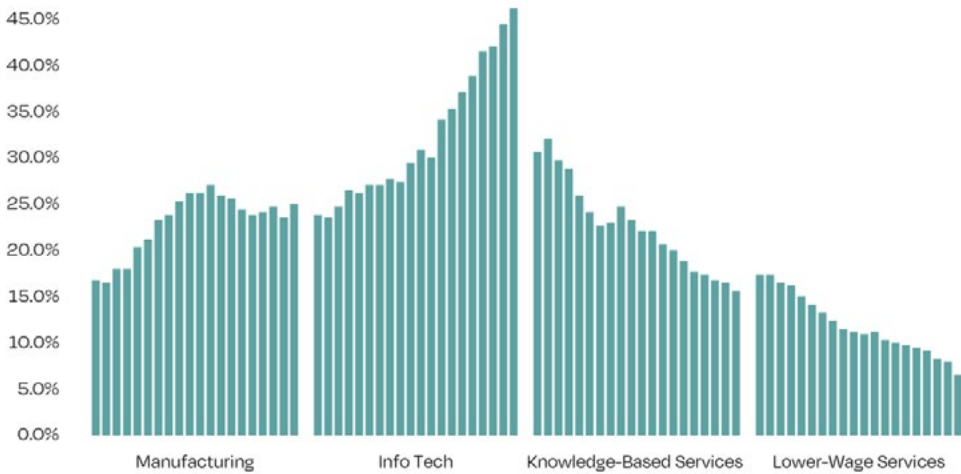


That Silicon Valley has entered into its own stratosphere of prosperity has made it the geography of aspiration: a veritable North Star of economic progress. This has led to the pervasive, copycat strategy to become “the next Silicon Valley.” Ethernet inventor Robert Metcalfe wrote in 1998 that “Silicon Valley is the only place on earth not trying to figure out how to become Silicon Valley.”^{xiii} “This often entails a place-branding campaign to christen a part of one’s city as Silicon “X”. For example, Philadelphia had branded part of its city as “Philicon Valley,” whereas New York has “Silicon Alley.” New Orleans has “Silicon Bayou” and Portland has “Silicon Forest.” There’s “Silicon Swamp” in Gainesville, “Silicon Slopes” in Utah, “Silicon Harbor” in Charleston, and a variant of “Silicon Prairie” in Dallas, Chicago, Omaha, and Jackson Hole, Wyoming. Such efforts have struggled, with Las Vegas’ multi-million dollar “Downtown Project” having arguably the highest profile of unsuccess.^{xiv}

Beyond the want for wealth, becoming the “next Silicon Valley” also means growing a high-tech footprint. Figure 3 shows how San Jose’s industry mix has evolved across time. Industrial sectors were broken down into four categories: (1) manufacturing; (2) knowledge-based services (e.g., finance, insurance, real estate, management, education, and healthcare); (3) lower-wage services (e.g., retail, leisure and hospitality, administrative support, personal service); and (4) information technology (e.g., information, professional, scientific, and technical services). The share of GDP

from information technology in San Jose skyrocketed from 24% in 2001 to 46% in 2020. Meanwhile, the share of GDP coming from its service sectors declined, going from 30.6% to 15.6% for knowledge-based services and 17.4% to 6.6% for lower-wage services. San Jose’s Manufacturing output rose to 25%, up from 16.9% in 2001. This trendline is not surprising given San Jose is an epicenter of advanced manufacturing, defined as the “rapid transfer of science and technology (S&T) into manufacturing products and processes.”^{xv} An example, here, is the imbuing of IT into the manufacturing process via the “internet of things,”^{xvi} or else deploying robots on assembly lines, or else hardware manufacturing, like semiconductors.

Figure 3 Share of Total Real GDP by Sector for San Jose, CA MSA, 2001 to 2020. Source: BEA



The same industry mix dynamics are going on with other tech hubs. From 2001 to 2020, San Francisco increased its share of economic output from information technology to 35.3%, up from 17.9%. (See Figure 4.) Note the corresponding declines in knowledge-based services (35.6% → 27.6%) and lower-wage services (17.6% → 11.3%). In Boston, the growth in IT as a share of GDP went from 18.2% to 28.6%. Boston’s knowledge service sector, too, declined (43.4% → 38.7%) but not as much as in San Jose and San Francisco, in no small part due to the economic heft of Boston’s education and healthcare sectors, or the “eds and meds.” Beantown’s lower-wage service sector didn’t fare as well, contracting from 15.5% to 11.5%.

So, the basic industry mix trends for the three tech hubs are this: clear growth in economic output from information technology, slight growth in manufacturing, and clear declines in knowledge-based and lower-wage services.

For a less tech-centric economy, like Cleveland’s, these trends aren’t as accelerated (See Figure 6). The region’s output from its information tech sector has edged up since 2001 (8.8% → 11.8%). Cleveland is primarily a knowledge-based service economy, comprising nearly 43% of its GDP, higher than it’s ever been. The region is reliant on both white-collar (finance, real estate) and pink-collar (healthcare) services.

Figure 4 Share of Total Real GDP by Sector for San Francisco MSA, 2001 to 2020. Source: BEA

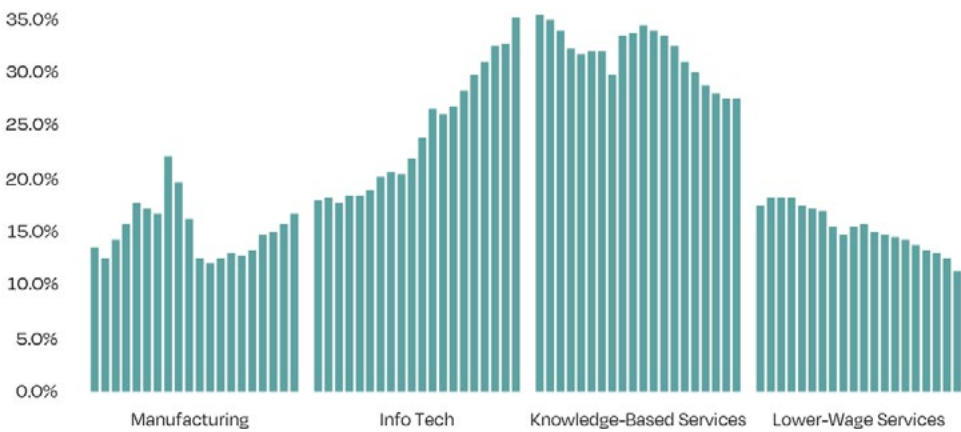


Figure 5 Share of Total Real GDP by Sector for Boston MSA, 2001 to 2020. Source: BEA

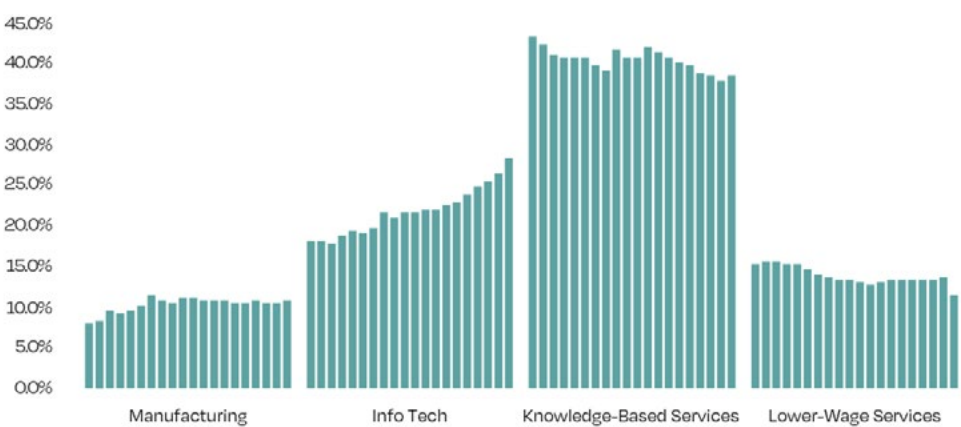
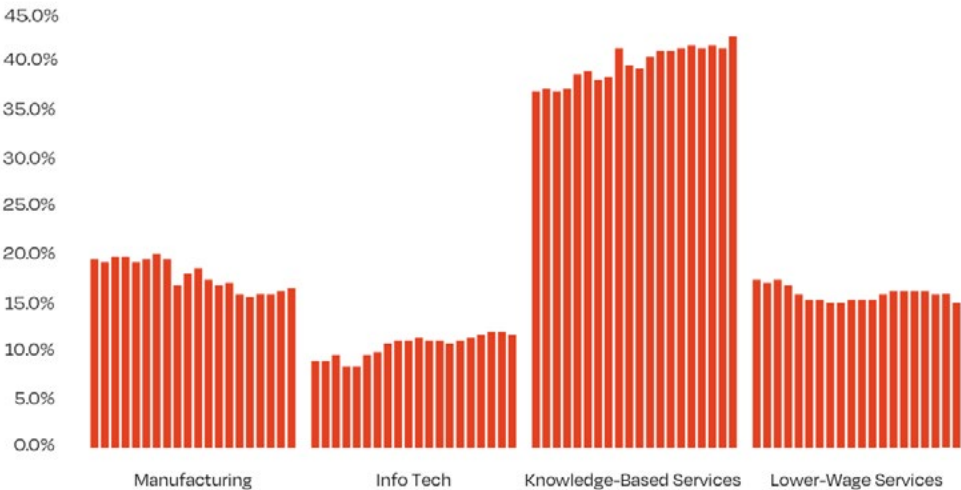


Figure 6 Share of Total Real GDP by Sector for Cleveland MSA, 2001 to 2020. Source: BEA



What's going on here? Creative destruction plays a part. In 2011, venture capitalist Marc Andreessen wrote an article entitled “Why software is eating the world.”^{xvii} “More and more major businesses and industries are being run on software and delivered as online services...” Andreessen wrote, “with new world-beating Silicon Valley companies doing the disruption in more cases than not.” He then goes on to explain how we got to that point. “Six decades into the computer revolution, four decades since the invention of the microprocessor, and two decades into the rise of the modern internet, all of the technology required to transform industries through software finally works and can be widely delivered at global scale.”

The operative words, here, are “transform industries through software” and “global scale.” We have Netflix eating cinema, Amazon eating retail, Door Dash eating going out to eat, Lyft eating transportation, Airbnb eating hotels, Facebook eating journalism, Google eating advertising, and various advances in fintech, edtech, and medtech eating occupational activities in finance, education, and healthcare. This helps explain the trendlines above in which industry mix in advanced economies is shifting away from services and toward IT. And while the information technology sector is not a standalone industry per se, but rather a set of human-machine interactions that range from hardware to software to user interfaces to digital data banking to use-case algorithms that — when deployed — disrupt industries by gobbling up the customer base, the fact of the matter remains: innovation's essence — its original intent — is to find a better way, or to make what was inefficient efficient, and less useful more useful. Ultimately, this means a better a product or service and a better way to produce that product or render that service, all the while shrinking the on-demand lag between when one wants and when one gets.

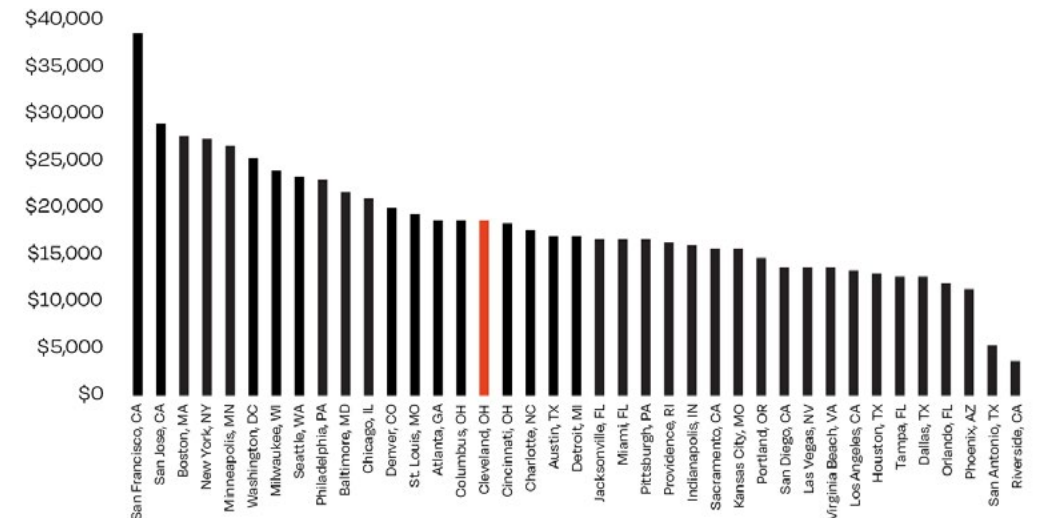
Of course, profit is very much on the mind of inventors, entrepreneurs, and executives as they race to gain market share under the cover of economic growth. Money motivates. Yet as the pace of disruption gets quicker and quicker, and as the technologies we deploy get better and better, a finer and finer line is separating economic development and community development, or economic progress and societal regress. We offer a few data points in support of this observation. More follow.

While per capita income can tell us about a region's average prosperity, it doesn't tell us about its distribution. When comparing per capita income with per capita income differences by race, what we find is telling: the most prosperous, technologically-advanced regions are also the most inequitable. According to the latest data from the American Community Survey (ACS), the largest gaps in per capita incomes between white and Black residents were found in San Francisco, San Jose, CA, and Boston (See *Figure 7*). The Cleveland metro — with an income gap of \$18,427 between white and Black residents — ranks 15th worst out of the largest 40 metros. It's quite possible that if Cleveland's policymakers simply grease the wheels of innovation, disparities will inevitably worsen.

Aerial view of University Hospitals and Medical Center, circa 1940
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University



Figure 7 Differences in Per Capita Income Between White and Black Residents in Top 40 Metros.
Source: ACS 1-Year, 2019.



That's because this paradox of progress is less a bug than a feature of the modern economy. As shown in *Figure 8*, a correlation analysis between per capita income and income gaps by race was run for all micropolitan and metropolitan statistical areas where data was available. There is a strong positive correlation between how wealthy a region is and how disparate it is as far as White and Black income ($r^2 = 0.54$).

Figure 9 takes the notion that tech-induced prosperity exacerbates disparity a bit further, plotting metros by their concentration of jobs in mathematical and computer occupations against wage inequality, assessed by the 90/10 wage ratio, or the gap between what the wealthiest 10% makes versus the poorest 10%. The larger the ratio, the greater the inequality. There's a strong correlation between tech job concentration and wage inequality ($r^2 = 0.63$), with San Jose, CA the posterchild. Now, if cities are still falling over themselves to be slouching toward Silicon Valley, policymakers should be prepared to answer the question, “Why?”

Tech-induced prosperity exacerbates disparity a bit further.

Figure 8 Per Capita Income and Income Gaps by Race for U.S. Regions. Source: ACS 1-Year, 2020. Cleveland in red.

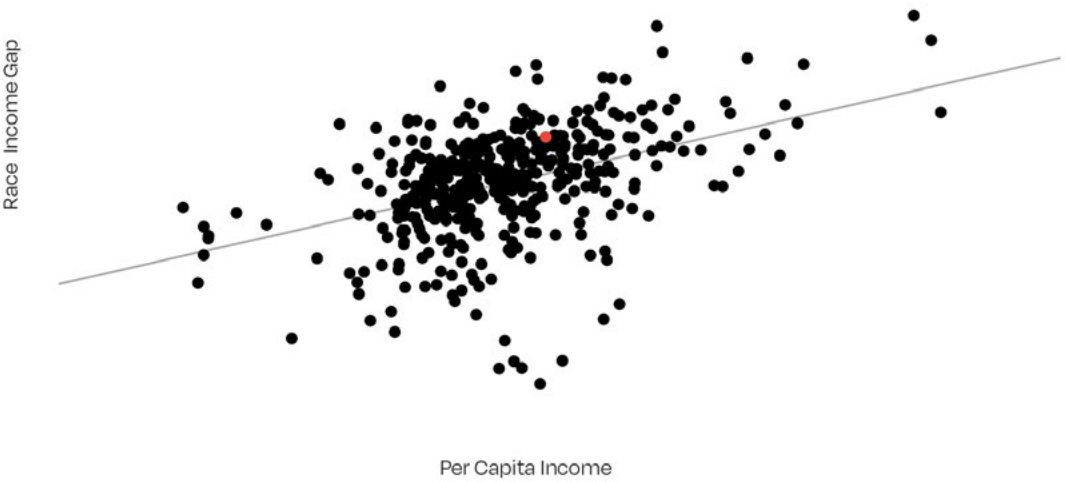


Figure 9 Share of computer and Mathematical Employment vs. 90/10 Wage Ratio by Metro. Source: OES, May 2020. Cleveland in red.



Case Institute of Technology, Cleveland, Ohio, circa 1960–1990
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

The operative words here, are “transform industries through software” and “global scale”. We have Netflix eating cinema, Amazon eating retail, Door Dash eating going out to eat, Lyft eating transportation, Airbnb eating hotels, Facebook eating journalism, Google eating advertising,

Act III:

In the wake of COVID-19, renowned management theorist Roger Martin penned a *Washington Post* essay headlined, “The virus shows that making our companies efficient also made our country weak.” “If there is a single economic policy lesson to learn from the coronavirus pandemic,” he writes, “it is that the United States’ obsession with efficiency over the last half century has brutally undermined its capacity

to deal with such a catastrophic event.”^{xviii} Martin explains the push by Wall Street’s “corporate raiders” in the ‘80s and the hedge funds more recently has led to “extreme pressure to cut costs,” largely through the automation and offshoring of labor, leaving not only lengthening supply chains open to disruption, but also the American working class closed off from aspiration — the latter Ohio Senator Sherrod Brown has referred to as “the dignity of work.”^{xix}

This balancing act between what’s good for the firm versus what’s good for society isn’t new. The leaning-and-meaning of the private sector was motivated by an aggressively normative belief that executives are “the agent of the individuals who own the corporation... and his primary responsibility is to them,” so notes economist Milton Friedman in his famed 1970 *New York Times* piece “The Social Responsibility of Business Is to Increase Its Profits.”^{xx} This worldview, called “the Friedman Doctrine” has impacted how and where money flows. The salary and wages of all workers as a percent of GDP is down to 59.7%, after peaking at 65% in 1970 (See Figure 10).

The same point can also be made by tracking what MIT’s Erik Brynjolfsson and Andrew McAfee have called “the great decoupling,”^{xxi} or the divergence between economic output and employment. Figure 11 shows this plainly, with San Jose, CA’s GDP growing by a factor of three from 2001 to 2020, while its growth in jobs stayed flat. That job growth stalled in America’s beacon of tech speaks volumes to the fact that innovation allows us to produce more with less. Economic advisor for then Vice-President Joe Biden, Jared Bernstein, referred to this decoupling as “the jaws of the snake.”^{xxii}

While these “jaws” are less open in Cleveland, the region’s separation of economic output from worker opportunity is still apparent (See Figure 12). Which brings us back to the main crux of this analysis: What are we asking for when we are wanting for innovation? What are we rooting for when we are rooting for growth?

Forced by closures and social distancing requirements [during the pandemic], firms are automating, even more, discovering new ways to harness emerging technologies to accomplish tasks with less labor.

Efficiently Insufficient

Figure 10: Wages and Salary Income as Percent of Gross Domestic Product, 1950-2019. Source: Federal Reserve Bank of St. Louis

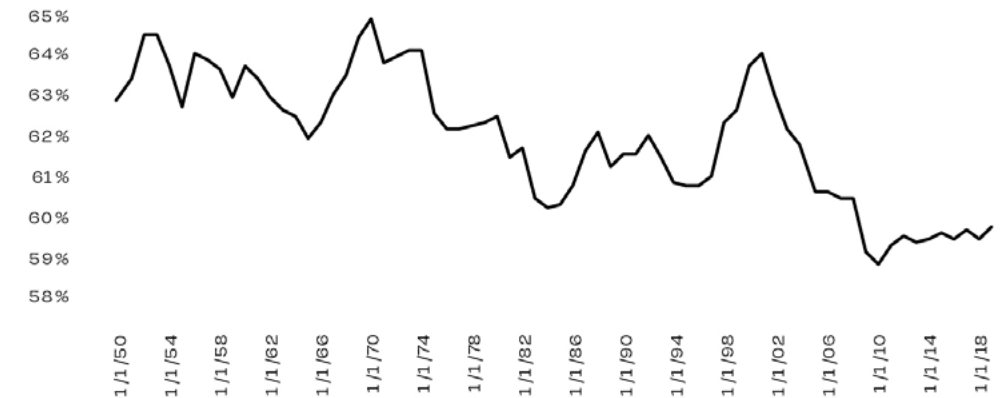


Figure 11: GDP Versus Employment in San Jose, CA MSA 2001 to 2020. Source: BEA, BLS. Index 2001 = 100

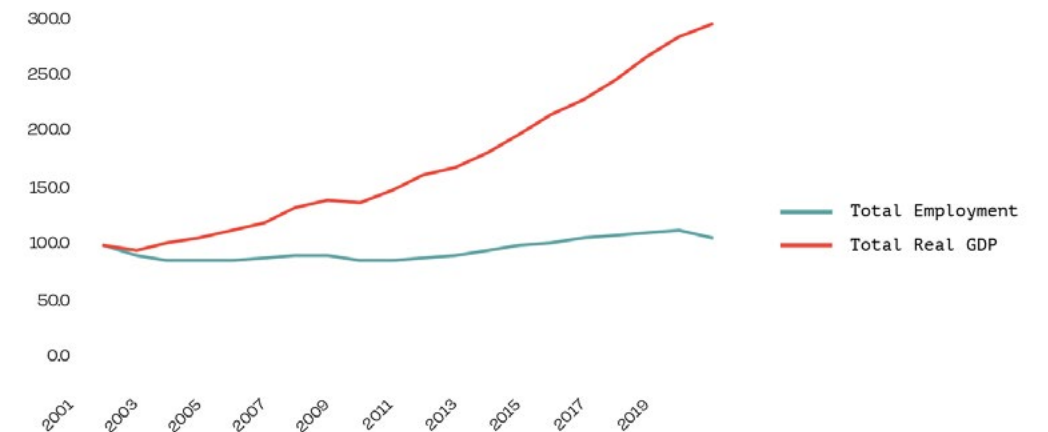
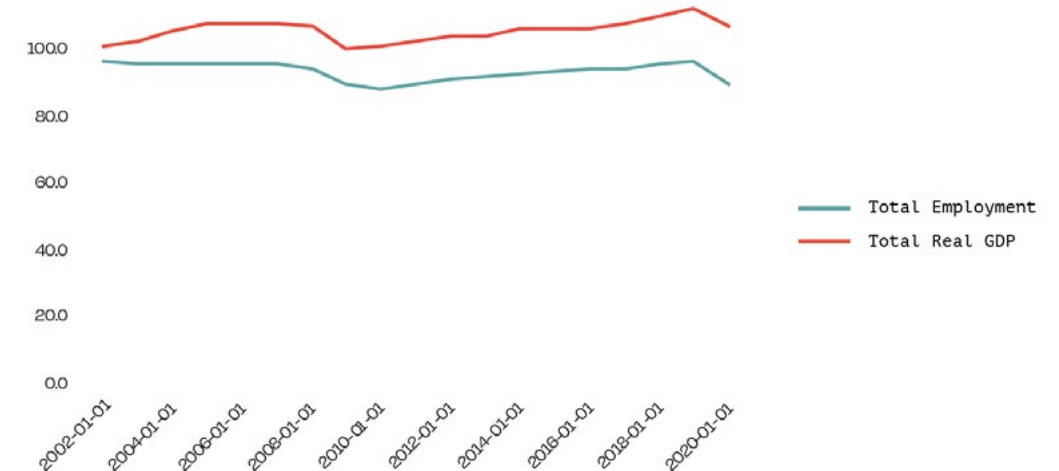


Figure 12: GDP Versus Employment in Cleveland MSA 2001 to 2020. Source: BEA, BLS. Index 2001 = 100



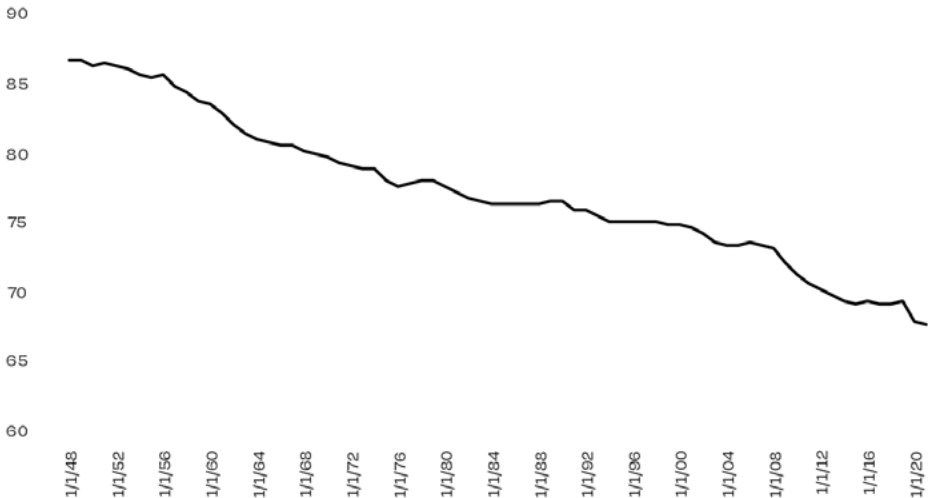
In a business-as-usual, do-nothing scenario, or in a non-purposed innovation policy environment wherein efficiency and profit stay at the forefront of thought, we are asking for trouble. That’s because the inequality and decoupling trends we have now will only worsen as the nascent economic landscape post-COVID goes full bloom. In the Brookings paper “Technology, growth, and inequality” by Zia Qureshi,^{xxiii} the author sums it up this way:

“[I]ncreased automation and telework triggered by the pandemic can further tilt the balance against less-skilled, low-wage workers. Forced by closures and social distancing requirements, firms are automating even more, discovering new ways to harness emerging technologies to accomplish tasks with less labor. This is happening more in industries with business models heavily reliant on human contact and a less-skilled workforce. The further consolidation of economic activity in large firms in product markets will reinforce recent trends toward higher wage inequality and lower labor income share.”

The effects will hit communities of color particularly hard. One recent McKinsey report, “The Future of Work in Black America,” noted that Black workers are 10% more at risk for job disruption due to automation, with that number rising to nearly 30% for Black men without a college degree.^{xxiv}

Echoing these findings is a January 2022 *New York Times* piece entitled “Economists Pin More Blame on Tech for Rising Inequality.”^{xxv} The author interviews MIT’s Daron Acemoglu, “an influential economist” at MIT whose research showed at least half of the gap in American’s wages over the last 40 years was due to “excessive automation,” particularly work done by men without college degrees. Given less than one-third of men in the U.S. have a college degree (the figure is 18.6% in the City of Cleveland), that’s a lot of displaced workers. This helps explain why the male labor force participation rate in America declined from 87% in 1940 to 68% by 2020. A sobering stat.

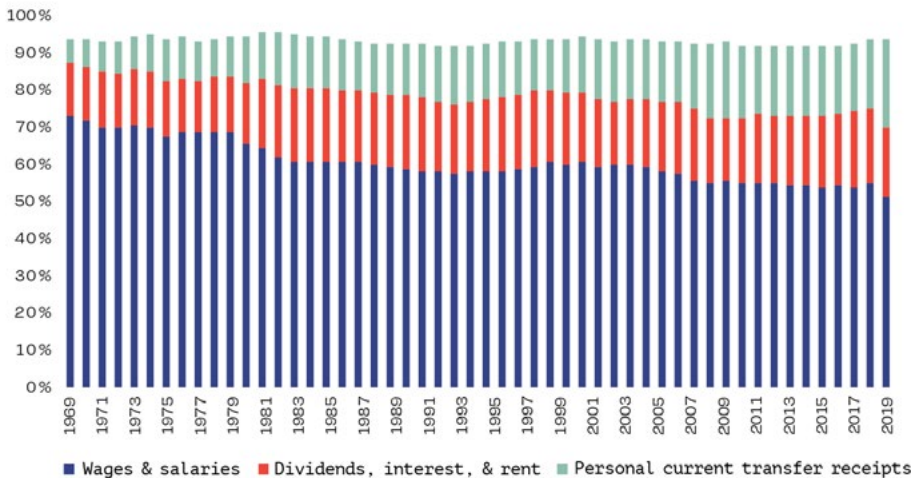
Figure 13: Male Labor Force Participation Rate for the U.S. 1948 to 2020. Source: BLS



It also helps explain concerning trends locally, particularly related to how Clevelanders get income. In 1969, nearly 74% of total income in the Cleveland metro came from salaries and wages. It came from work. By 2020, it went down to 52% (*See Figure 14*). What’s picking up the slack? Personal transfer receipts. This includes government aid from Medicare, food stamps, unemployment benefits, and Social Security. Nearly 24% of income in the Cleveland metro comes from such receipts, up from 6.5% in 1969. Income from dividends, interest, and rent is also rising. This is money paid to select individuals, particularly stockholders, lenders, and landowners. In 1969, 14% of total income in Cleveland was via these sources. That’s up to nearly 19%. This is the result of financialization of the economy, defined as “the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies.”^{xxvi}

Modern market practices, or using innovation to excessively displace workers or figure out novel ways for money to make money is, “not an act of God or nature,” continues MIT’s Acemoglu. “It’s the result of choices..we as a society have made about how to use technology.” The invisible hand of the market, then, is not divine decree. Rather, our market norms are heavy-handed — very visible and human-made. It’s choice. And choices have consequences.

Figure 14: Sources of Income in the Cleveland MSA, 1969 to 2020. Source: BEA



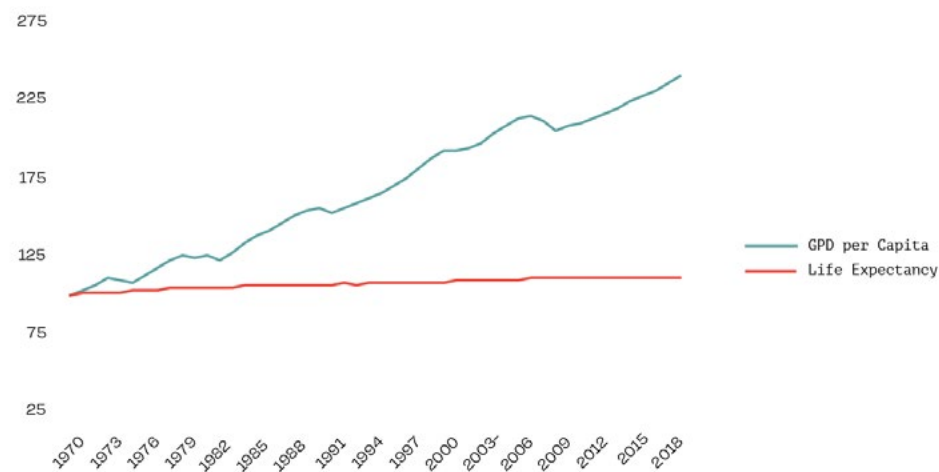
Act IV:

The Social Determinants of Health concept explains that 80% of one's health happens outside of the doctor's office, with the other 20% in the hands of healthcare practitioners.

Historically, proxies of economic growth, like GDP and GDP per capita, were predictive of development. This was particularly the case for developing nations where the low-hanging fruit of basic infrastructure investment, i.e., sanitation, potable water, electrification, transportation, vaccinations, food production, etc. created a feedback loop in which economic growth was coupled with

well-being as measured by rubber-meets-the-road metrics such as infant mortality and life expectancy. In advanced countries, however, economic growth and well-being have been decoupled. This is illustrated by *Figure 15* that shows while America's GDP per capita grew by a factor of nearly 2.5 since 1970, the gains haven't trickled down into well-being. Life expectancy has gotten stuck.

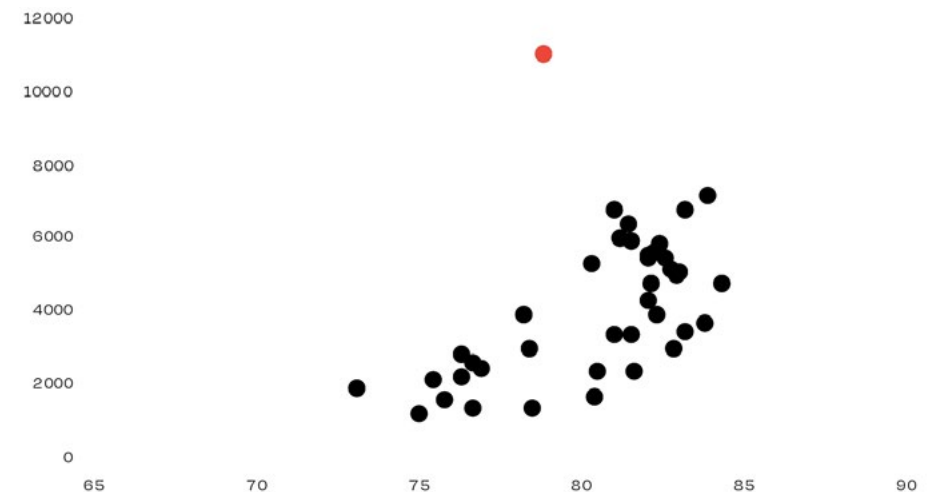
Figure 15: Avg. Life Expectancy versus GDP Per Capita for U.S., 1970 to 2019 Source: OECD Index 1970 = 100



This isn't because the U.S. lacks access to healthcare services and doesn't reap the gains of innovations in cutting-edge treatments. We spend more per capita on health care than anywhere in the world (\$10,950), yet life expectancy is middling. *Figure 16* shows the U.S. stands alone in the landscape of what is spent on healthcare versus what's received in longevity. **Why?**

Where's the Well-Being?

Figure 16: Life expectancy versus health spending per capita. Source: OECD, 2019. U.S. in red.



In their study “Life Expectancy and Mortality Rates in the United States, 1959–2017” in *JAMA*, the authors find that stalled longevity is a function “of midlife mortality... increasing across all racial groups, caused by drug overdoses, alcohol abuse, suicides, and a diverse list of organ system diseases.”^{xxvii} The deaths are geographically specific, with 8 of the 10 states with the largest increase of excess deaths in the Rust Belt or Appalachia, particularly in the communities of the Ohio Valley. “The notion that U.S. death rates are increasing for working-age adults is particularly disturbing because it is not happening like this in other countries,” said Steven Woolf, the lead author. “This is a distinctly American phenomenon.”

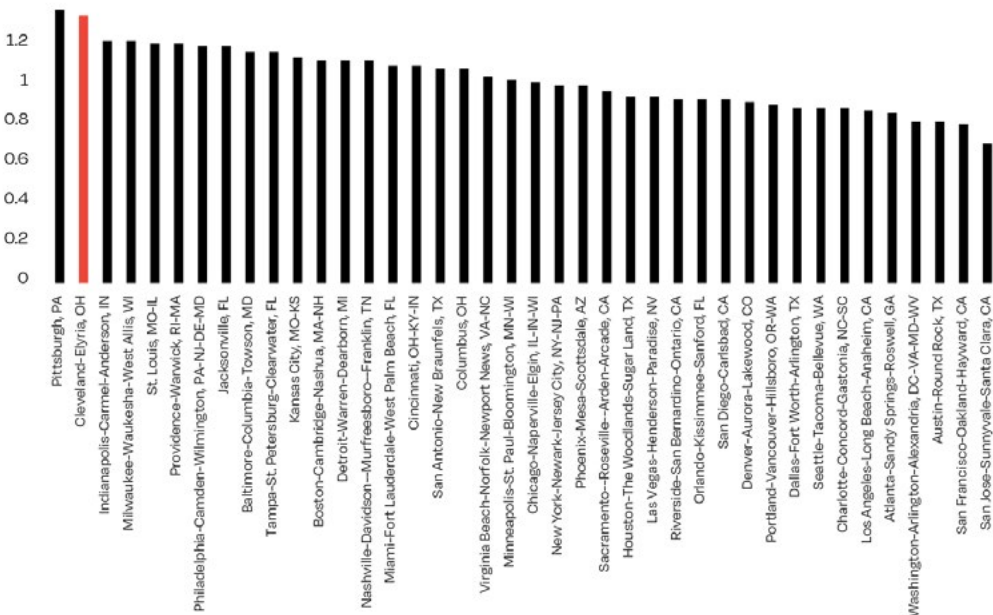
We return to words that began this analysis. A society that functions flows into the physical and mental welfare of its citizens which, in turn, feeds back into the functioning of society. A society that doesn't, doesn't.

This reality — or what's outside and societal affects what's inside and individual — is termed the “social determinants of health”^{xxviii} (SDOH): a concept that's moved from the borders of academia into the discourse of a general consensus. The shorthand explanation of SDOH is that 80% of one's health happens outside of the doctor's office, with the other 20% in the hands of healthcare practitioners. Put another way, issues like schooling, employment, income, housing, neighborhood conditions, and health behaviors matter. As do the policies that structure those domains. SDOH has become a hot-button topic that's proving to be a looking glass for the healthcare

industry specifically, and for the American experiment generally — particularly that balance between what’s consumed, like healthcare services, and what’s produced, like health. Or to take the tech sector to task, what’s consumed: social media, and what’s produced: distrust and polarization.

It’s also proving to be a looking glass at how cities, like Cleveland, invest in economic development, utilizing strategic frames such as innovation to kickstart growth. An unpacking of Cleveland’s healthcare industry will prove insightful. The region is one of the most impactful places globally when it comes to healthcare talent and innovation. This is evidenced by *Figure 17* that shows the location quotient (LQ) for skilled healthcare occupations for the largest 40 MSAs nationally. (An LQ is a statistic that measures a region’s industrial specialization relative to the nation.) Among the top 40 labor markets, Pittsburgh is 1st with an LQ of 1.29, followed by Cleveland (1.26).

Figure 17: Location Quotient of Healthcare Practitioners and Technical Occupations for Largest 40 Metros. Source: Occupational Employment and Statistics, May 2019.

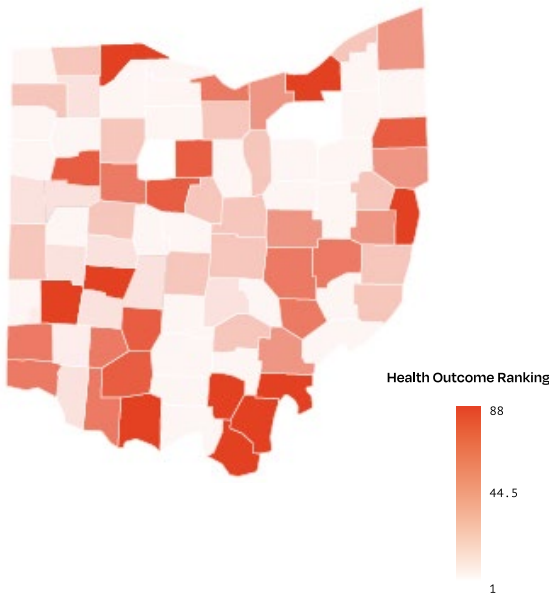


Cleveland’s healthcare scene is particularly concentrated in Cuyahoga County. The county has the 7th most hospital employees in the nation, despite being the 35th largest by population (*See Table 1*).

Table 1: Top 1 Counties Nationwide by Total Hospital Employment. Source: County Business Patterns, 2017.

	Number of Employees for Hospitals	% of Total Employees in Hospitals
Los Angeles County	162,879	4.3%
Cook County	121,563	5.1%
New York County	99,441	4.4%
Harris County	96,346	4.7%
Suffolk County	88,805	13.9%
Philadelphia County	67,244	10.6%
Cuyahoga County	64,661	9.8%
Maricopa County	63,752	3.8%
Dallas County	49,134	3.3%
San Diego County	49,031	3.9%

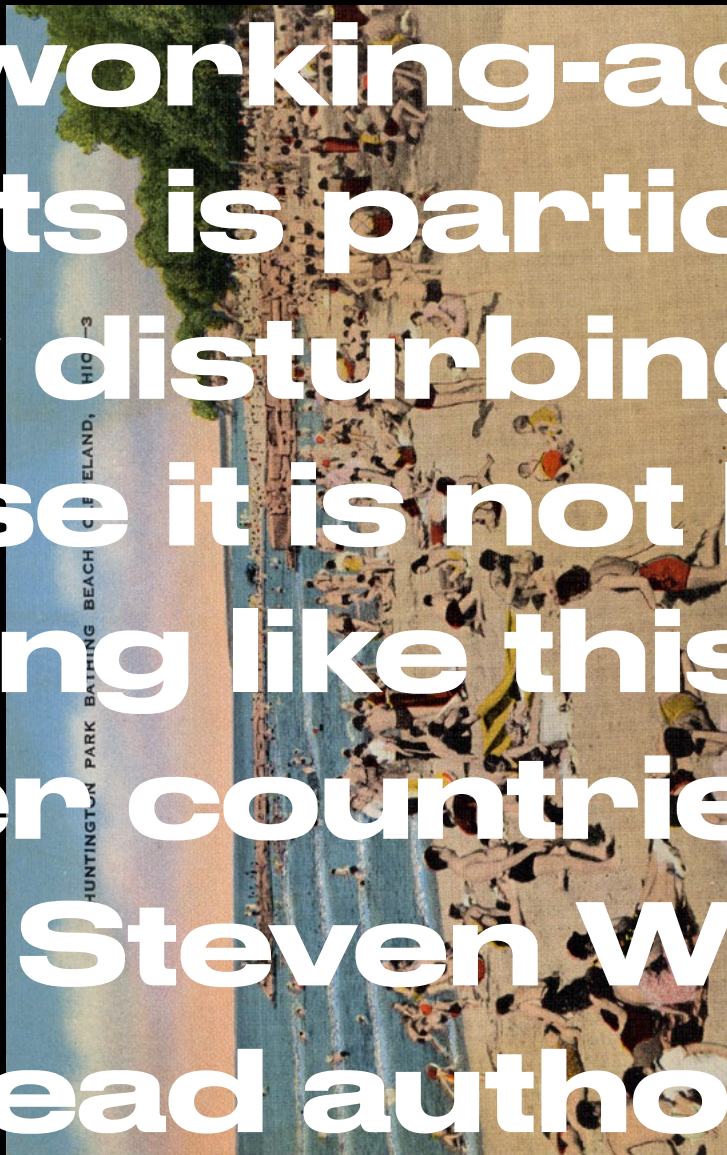
Figure 18: Health Outcome Rankings State of Ohio. Source: 2020 County Health Rankings



Given Cleveland’s status as a world-class healthcare innovator, one could assume that those resources would translate downstream into good local health. According to the University of Wisconsin’s Population Health Institute 2020 figures, however, Cuyahoga County ranks 75th out of 88 counties in health outcomes for the State of Ohio (*See Figure 18*). Ohio’s Appalachian counties are the only ones that rank below it.^{xxix}

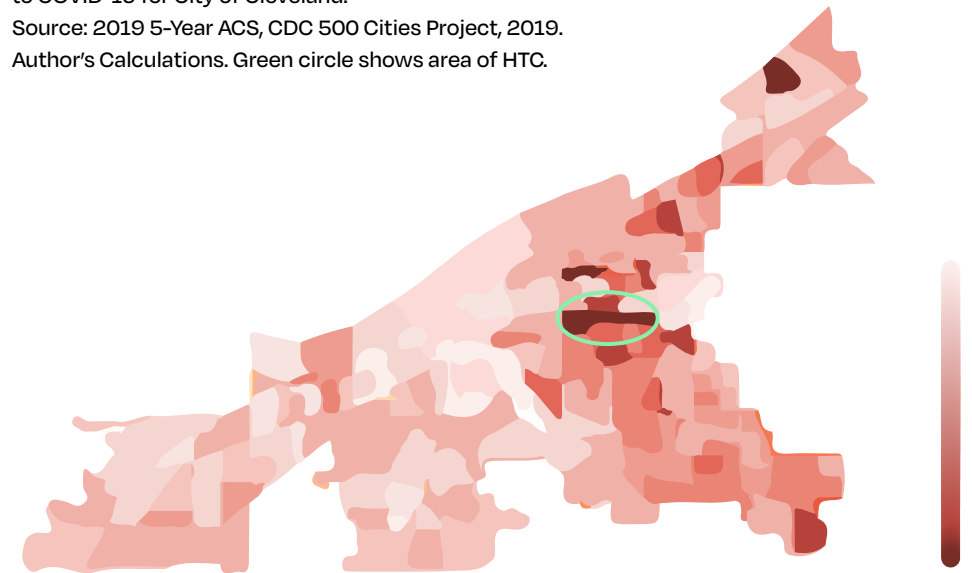
The dissonance is present at smaller geographies as well. The City of Cleveland’s Health Tech Corridor (HTC) — a key geography in the proposed Cleveland Innovation District — is a 2.87 square mile stretch that runs from Downtown Cleveland to Cleveland’s University Circle. That stretch houses nearly 40% of Cuyahoga County’s healthcare and social assistance jobs, despite comprising only 0.6% of the county’s land mass.^{xxx} Yet the HTC is also home to neighborhoods with some of the worst health outcomes. An analysis of the census tracts that are most vulnerable to COVID-19 complications — as gauged by the concentration of residents 65 and older as well as areas with the highest prevalence of high blood pressure, cardiovascular disease, diabetes, cancer, and chronic obstructive pulmonary disease (COPD) — revealed that two of the top five most vulnerable census tracts in Ohio were within the HTC’s boundaries (*See Figure 19*).

“The notion that U.S. death rates are increasing for working-age adults is particularly disturbing because it is not happening like this in other countries,” said Steven Woolf, the lead author. “This is a distinctly American phenomenon.”



Huntington Park Bathing Beach, Cleveland, Ohio, circa 1940
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

Figure 19: Neighborhoods by Density of Vulnerable Populations to COVID-19 for City of Cleveland.
Source: 2019 5-Year ACS, CDC 500 Cities Project, 2019.
Author's Calculations. Green circle shows area of HTC.



Why is Cleveland’s health innovation landscape not showing up in local population health? The issue is less about innovation and automation than innovation and globalization. Increasingly, education and healthcare, or the “eds and meds,” has become a globalized industry. Hospitals and universities have taken on the air of a worldwide headquarters, or a place in a city — not necessarily of the city — where innovation happens so a good or service is bettered so market share is grown. A global hospital can become divorced from its local community. Novel strategies are needed to ensure a city’s world-class assets are more effectively tethered to its local needs.

Novel strategies
are needed to
ensure a city’s
world-class
assets are more
effectively
tethered to its
local needs.



Toboggan slide at Mill Stream Run Reservation in Strongsville, 1974
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

Where’s the Well-Being?

Act IV:

Act V:

A policy prescription through the strategy of investing in the region's R&D assets with the aim of pointing this knowledge toward where it matters most: at the well-being of Clevelanders.

State Income Growth.”^{xxxii} In it, the analysts showed a state's long-run per capita income growth was driven by three factors: educational attainment, levels of R&D and patenting, and a higher-tech industry mix. Put another way, educated people, the knowledge production activities done by those people, and the industries transformed from those knowledge production activities — these factors all comprise the process of innovation.

Enter the concept of innovation districts, which are physically designed places meant to foster efficacy in the process of innovation itself. The definition of innovation districts has been clarified over time as “areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators and accelerators.”^{xxxiii} That anchor institutions are a focus, here, is no coincidence, as universities and research hospitals directly affect the factors of innovation, particularly levels of human capital via college graduates, and knowledge production activities via R&D. Market actors then get spun out of this knowledge production in the form of start-ups, or the knowledge gets absorbed by established firms, evolving those firms' competitiveness and, in turn, the competitiveness of the region's industries.

The byproduct of an innovation district is to be found in regional metrics, such as increased GDP, a higher tech industry mix; more start-ups; more high-tech jobs; and higher per capita income. But as shown prior, unintended consequences of innovation can be found downstream at the level of the community in the form of economic displacement, income disparity, and ill-health. Such damned-if-you-do-and-damned-if-you-don't scenarios have been referred to as “the progress trap,” defined as societal conditions advanced economies find themselves in “when science, technology and industry create more problems than they can solve.”^{xxxiv} Policymakers have to find

Innovation districts are common.^{xxxi} Examples include Kendall Square in Boston, University City in Philly, Cortex in St. Louis, South Lake Union in Seattle, The Detroit Innovation District, and The Research Triangle Park in Raleigh Durham. The rationale for these districts can be found in a Federal Reserve Bank of Cleveland annual report entitled “Altered States: A Perspective on 75 Years of



Lake pool, circa 1965
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

Intentional Innovation

ways out of this trap. There are a few policy avenues that can carve a path forward. None are silver bullets but they all, in tandem, play a role in bridging the divide between what's good in the boardroom and on the block. One is the reshoring of good-paying manufacturing jobs. See, for instance, Intel's decision to bring chip manufacturing to Ohio.^{xxxv} If those chips, however, are simply used to displace workers in various customer-facing industries down the line, then the societal benefits of reshoring will be for naught. It's like bailing water out of a boat while there's a hole in the hull.

Which brings us to another policy thread to pull on, one eloquated nicely by MIT's Erik Brynjolfsson in the 2022 essay “The Turing Trap: The Promise & Peril of Human-Like Artificial Intelligence.”^{xxxvi} For long, the race to a better AI meant designing the scientific advances to mimic human thought, with the barometer of success being unable to tell if one was talking to a computer or a person, aka the Turing imitation game. This is a goal in bettering natural language processing technologies like Siri and Alexa. While initially unintentional, this has led AI to become stacked on processes that are human-like, or HLAI.

Why does this matter? Because if AI is designed to *mimic* human behavior then it becomes a *substitute* for human behavior. It becomes labor displacing. This is in contrast to an AI that is complimentary to humans, in which case it is labor enhancing. “[W]hen AI is focused on augmenting humans rather than mimicking them,” writes Brynjolfsson, “then humans retain the power to insist on a share of the value created... [A]ugmentation creates new capabilities and new products and services, ultimately generating far more value than merely human-like AI.” While both types of AI can be beneficial, Brynjolfsson explains, there remains “excess incentives” for automation, not augmentation, among technologists, executives, and policymakers.^{xxxvii}

We need more intentionality in how we innovate. It's not enough to modernize with a sole focus on the product in service of firm profit. That's “checkers.” “Chess” is broadening the aperture of innovation to include how people produce and consume said product. To that end, economic and community development have come to exist on parallel paths. One could argue community development now exists to pick up the pieces of economic development. These pillars of city building should operate more as a feedback loop whereby what's good for the economy is good for society and vice versa.

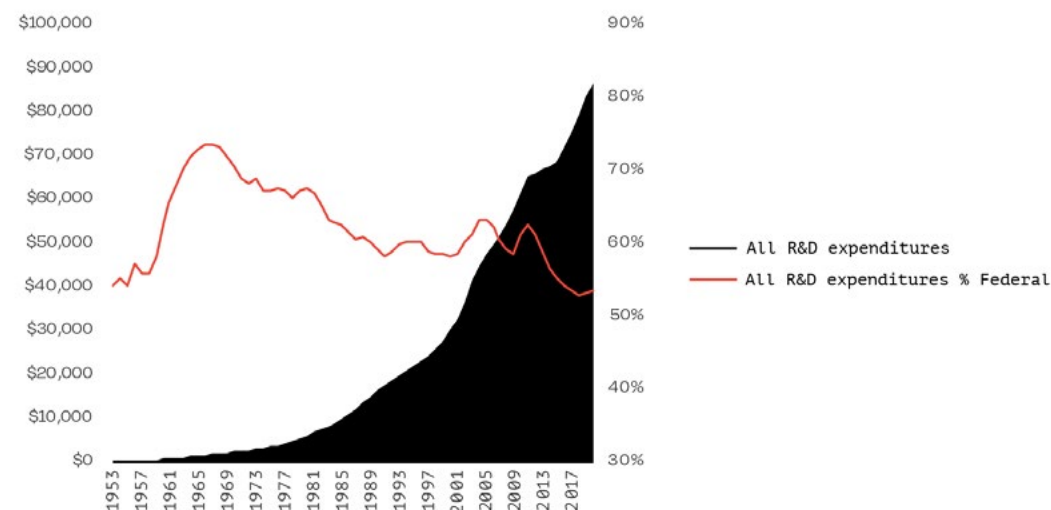
Relatedly, intentional innovation also involves deciding on what problems we choose to tackle with our technological capacity. For example, the 2018 Cleveland

State University report “The Healing Economy”^{xxxviii} posited a simple question: **Why isn’t innovation being prioritized to solve the problems of everyday living?** Think Cleveland focusing on using next-gen technologies to tackle health disparities in the neighborhoods. This is an example of what economist Mariana Mazzucato, a professor at University College London and founder of the Institute for Innovation and Public Purpose, calls “mission-oriented innovation policies,” described as “systemic public policies that draw on frontier knowledge to attain specific goals, or ‘big science deployed to meet big problems.’”^{xxxix}

Purposed innovation is hardly new. Public-facing R&D arose as a policy prescription out of World War II. In a letter written in 1944, President Roosevelt addressed Vannevar Bush, the director of the office of scientific research and development, recognizing his group’s success in applying scientific knowledge to “the technical problems paramount in war.”^{xl} “There is, however, no reason why the lessons to be found in this experiment cannot be profitably employed in times of peace,” President Roosevelt continued, noting that knowledge can be generated to improve national health and raise the standard of living. Roosevelt concluded: “New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life.”

A year later, a report was produced called “Science: The Endless Frontier,” which conceived of the National Science Foundation.^{xli} That report kicked off an era in the ‘60s in which over 70% of all R&D was funded by the federal government (*See Figure 20*). It was a time of discovery that laid the foundation for computer science and today’s Digital Age. “[T]he government has been part of the Silicon Valley story all along,” explains tech historian Margaret O’Mara, “even though it is something that the Silicon Valley mythos of the free enterprise capitalist cowboy running and writing in the setting sun...leaves out.”^{xlii}

Figure 20: R&D Funding in the U.S., 1953–2019, in thousands. Source: NSF



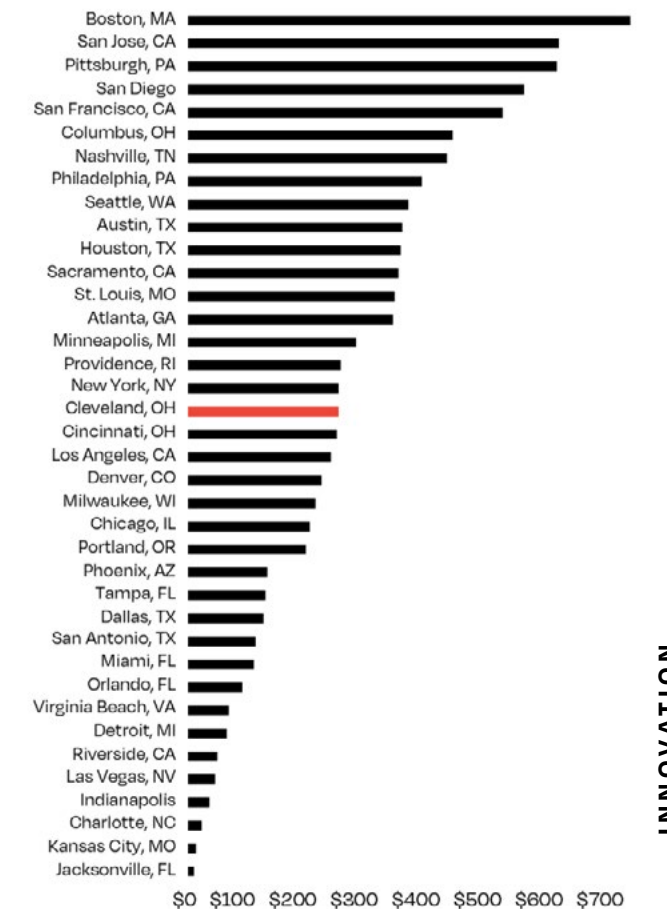
R&D has long been recognized as a driver of innovation.^{xliii} According to the latest figures from the OECD,^{xliv} the U.S. invests 3.1% of its GDP on R&D, good for 10th out of some 44 peer countries. Israel is first at 4.9% followed by South Korea (4.6%) — two countries known for their technological advances on the world stage.^{xlv}

There’s a lengthy body of research^{xlvi} showing R&D concentration predicts a more productive regional economy as well, including a study by these authors commissioned by Global Cleveland that found R&D funding received was one of the strongest predictors of a metro’s GDP per capita growth.^{xlvii} Despite the bias in economic development that lauds start-up culture and its venture capital and unicorns as integral, it’s really the star scientists producing R&D that are the “tip of the spear” to innovation and its evolutionary, multiplying effects on a city’s economy.

How does Cleveland fair? The NSF’s Higher Education R&D data estimates the amount of R&D funding a given metro’s colleges and universities receive each year. Total funding can be calculated on a per capita basis to control for population, in effect giving a metric that gauges R&D concentration.^{xlviii}

Boston and San Jose rank first and second, while San Francisco is fifth. Cleveland is 18th, (led by its R&D in life science and health sciences). Note Rust Belt peer Pittsburgh ranks 3rd due to its funding in computer and information science, life science, and health science. Columbus, too, performs well, ranking 6th, due to engineering and health sciences.

Figure 21: Per Capita R&D for Top 40 Metros. Source: NSF, HERD 2019



Cleveland has some room to grow when it comes to knowledge production. The last section sketches a policy prescription through the strategy of investing in the region’s R&D assets with the aim of pointing this knowledge toward where it matters most: at the well-being of Clevelanders. The prescription will be guard-railed by the most basic of questions so as not to dilute focus: **Innovate What? Innovate Why? Innovate How?**

Act VI:

When it comes to making innovation intentional, there's arguably no better mission for Cleveland to tackle than addressing public health in the midst of a public health crisis, or urban health in a city replete with poor population health.

natural language processing (NLP) that allows humans and computers to talk via conversant, or natural, language. NLP can also be used to harvest insights in the policy domain. It's not limited to consumer technology. This analysis fashioned a novel NLP algorithm called a Bidirectional Encoder Representations from Transformers (BERT) originally created by Google to assess Cleveland's R&D strengths. Being able to methodically map the region's R&D assets is crucial in figuring out what Cleveland should be innovating in.

Our model was trained on text data made available from the NSF that contains the abstract and keywords of every federal grant Cleveland researchers received for the time period 2018 to 2020; that is, instead of us researchers trying to read through the thousands of pages of NSF documents and then attempting to "eyeball" what Cleveland's scientists are getting funded in, we train AI to do so, with the output being a topic model, defined as a type of text-mining tool for the discovery of hidden semantic structures in a text body.¹

The findings can be found in *Appendix A*, which shows the top 20 semantic structures, or topics, that emerged from the BERT analysis. A visual companion to *Appendix A* is shown in *Figure 22*. The colors of the dots refer to the topical clusters, and their size correspond to the amount of times they showed up in our text sample and thus their topic rankings. The top four ranked topics are labeled in the visualization. Each R&D asset identified won't be discussed, though the full list has great insight for Cleveland's policymakers in its own right. See, for instance, that two of the top 20 topics identified (4 & 12) deal with cognitive and brain health, particularly as it relates to strokes and dementia. This research acumen lends itself to Cleveland Clinic's Neurological Institute

Innovate What? AI can assist humans across domains, augmenting ways to gain knowledge. Years back, when someone wanted information they'd reference a book called "the Yellow Pages." Today, if people want info they ask their phone, car, TV, watch, etc. utilizing a method of AI called

Playing volleyball in the Cleveland Metroparks, circa 1980-85
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University



Hey Siri, What Does Cleveland Research and Develop?

in the works.ⁱⁱ Likewise, Cleveland has a strong research presence in pathogens and viral infections (fifth in our list) that dovetails with the proposed Global Center for Pathogen & Human Health Research that Cleveland Clinic is building as part of the Cleveland Innovation District buildout.ⁱⁱⁱ

Next-gen technologies, like genomic sequencing, conducted at University Hospitals Center for Human Genetics, in partnership with Case Western Reserve University School of Medicine's Department of Genetics and Genome Sciences,ⁱⁱⁱⁱ comprise the totality of the third ranked topic, which includes the terms "genetic," "mutation," "DNA," "expression," and "genomic sequence." While the second ranked topic that focuses on understanding "molecular mechanisms" — coupled with the ninth ranked involving "protein binding" — are likely related to the work that Cleveland State and the Cleveland Clinic are doing at the Cellular and Molecular Medicine Specialization, which conducts "cellular and molecular research to understand disease causes and disease mechanisms."^{lvi}

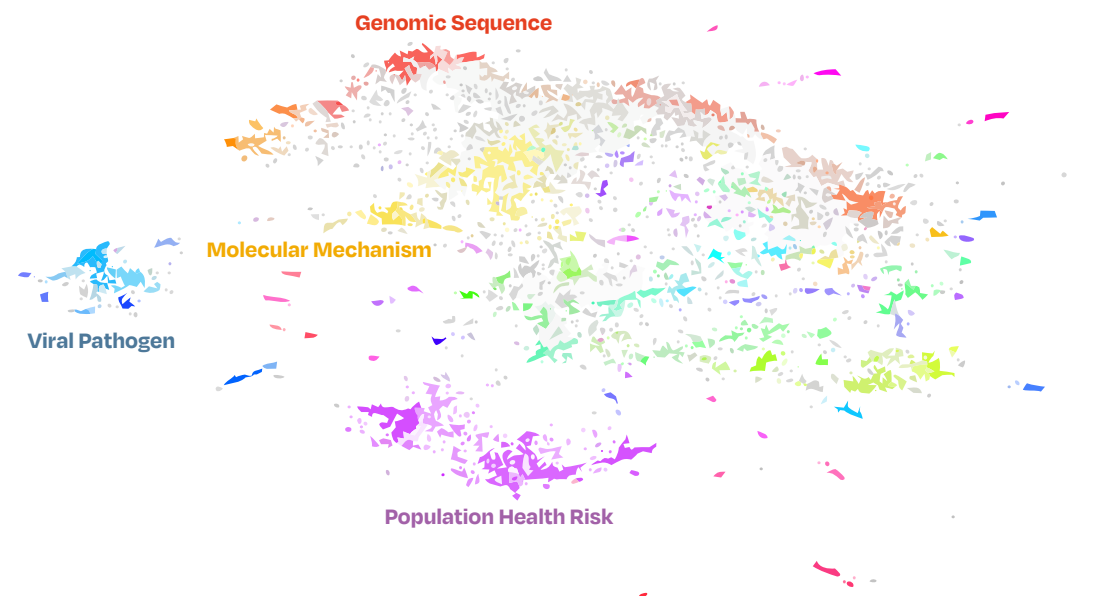
Innovate Why? This is all well and good. But if the topics just discussed remain removed from the society they are a part then this analysis has failed, as the uncontextualized topics on their own represent the standard model of economic development: "juice" innovation in promising high-tech fields for the sake of tech transfer as measured by patents, firm evolution, and firm incubation. The task of this analysis, however, is to envision a framework that innovates with purpose using a mission-oriented approach. Granted, this sounds like a lot of heavy lifting. Innovation is hard enough. And when it comes to inclusivity, economic development policymakers are often concerned that adding another leg to the stool will only slow down the innovative work in a given scientist's domain. Understandable. Moonshots are a race. Disruption is fast-paced. But this needn't be the case. Disrupting innovation, after all, is really just reimagining innovation. It's not recreating the dots. It's just connecting them.

Take Cleveland's research acumen in genomics, genetic sequencing, genetic mutations specifically, and molecular and cellular biology more generally. We have discussed throughout that the world we live in — including the economies we construct — ultimately filter down into the communities that get carved out. These communities accrue amenities or disamenities that either exude determinants that are positive or determinants that are negative, where it then becomes absorbed in the "geography" of the mind and body of the person who lives there, influencing that person's physiology at the cellular and molecular

level either towards health or towards disease. This outside-in process makes up the field of epigenetics, described as “the study of psychosocial factors that impact biology through an epigenetic mechanism.”^{lv} It’s an emerging field.^{lvi} An impactful and purposeful field. “Social epigenomics is uniquely positioned at the intersection of population health and precision medicine,” explains one epigeneticist, “allowing us to understand how exposure to social and environmental stressors modifies the way in which genes are expressed and ultimately alter our risk for disease.”^{lvii} And while epigenetics as a standalone topic didn’t show up in our analysis as an R&D asset, its bookends are there, or the study of cellular and molecular process on one hand and the study of population health on the other.

In fact, the first ranked topic in our model coalesced around population health risk. Relatedly, the seventh-ranked topic centered on the terms “obesity,” “metabolic,” “cardiovascular,” and “liver,” referencing the cluster of metabolic conditions that occur together — e.g., high blood pressure, high blood sugar, excess body fat, and abnormal cholesterol — that increase the risk of heart disease, stroke, Type 2 diabetes, and liver disease: all chronic conditions that are overexpressed in the City of Cleveland. These health conditions are strongly stratified by race and income, and so would fall under the umbrella of population health. Efforts are already underway at the University Hospital’s Cutler Center for Men, whose mission in part is to “do better...in preventative screenings and offer chronic disease management.”^{lviii} Finally, note the sixth ranked topic that’s united by the terms “pain,” “opioid,” “alcohol,” “tobacco,” “addiction,” and “treatment.” These are the factors driving the public health crisis related to the aforementioned “deaths of despair.” Or the deaths of working-age, working-class Americans due to overdose, suicide, and organ failure.

Figure 22: BERT Topic Model of Cleveland R&D Funding. Source: NSF Star Metrics 2018–2020. Author’s Calculations



1930 National Air Races – Unknown Woman 1929 USA Cleveland Ohio
Image: courtesy of Repository: San Diego Air and Space Museum

When it comes to making innovation intentional, there’s arguably no better mission for Cleveland to tackle than addressing public health in the midst of a public health crisis, or urban health in a city replete with poor population health. Given Cleveland’s healthcare acumen, strong population health research, and philanthropic gravity, it’s a perfect proving ground in changing the way cities do economic and community development. Crucially, this would not just entail a philanthropic and community development effort. It’s a regional economic development strategy, too. Cleveland, for instance, could become a center of excellence in epigenomics and population health, with leading-edge products and services formed through the lens of health disparities becoming a significant part of the region’s export portfolio. Consider for a moment a health equity accelerator to be housed within the Cleveland Innovation District whose aims are laser-focused on incubating firms whose end user is a healthier person.

Innovate How? We discussed what Cleveland should innovate in and why but not how innovation can be facilitated. An innovation district is one type of intervention, with the rationale being physically co-locating knowledge workers near each other will encourage idea mixing. This analysis supplements that view by taking a less place-centric and more people-centric

approach. After all, knowledge work is done by knowledge workers and is shaped via knowledge transfer. This occurs as a network effect, as documented in the analysis “Mobile star scientists^{lix} as regional knowledge spillover agents.” From a policy standpoint, this means it is not enough to know what topics of research are key but also which researchers and what collaborations are key.

To shed insight on these issues a social network analysis^{lx} was done. Data was retrieved from the PubMed data base^{lxi}, which has peer-reviewed journal articles, clinical trials, and meta-analyses. The search was for the topic “Population health” published in the last five years. The published works reveal who has recently collaborated on scholarly research in “population health.” *Figure 23* shows the main network of all worldwide researchers who have at least three co-authored publications. Nodes in the map represent researchers and the size of the node delineates who in the network is well connected, i.e., they have a dispersed diverse network of colleagues. The node colors reveal which of the researchers has ties to researchers in Cleveland. The blue (●) nodes have no ties to Cleveland, while the aqua (●) nodes — while being outside of NE Ohio — have collaborated with Cleveland’s researchers.

Cleveland researchers have links to other scientists throughout the network; that is, the aqua nodes are well distributed. The only concentration of activity that Cleveland scientists do not have ample access to appears to be the thick cluster of large blue (●) nodes in the lower center of *Figure 23*. Most of these nodes appear to be located in Mainland China.

Figure 23: Global Network of Population Health Research. Source: PubMed, 2017–2022. Author's Calculations.

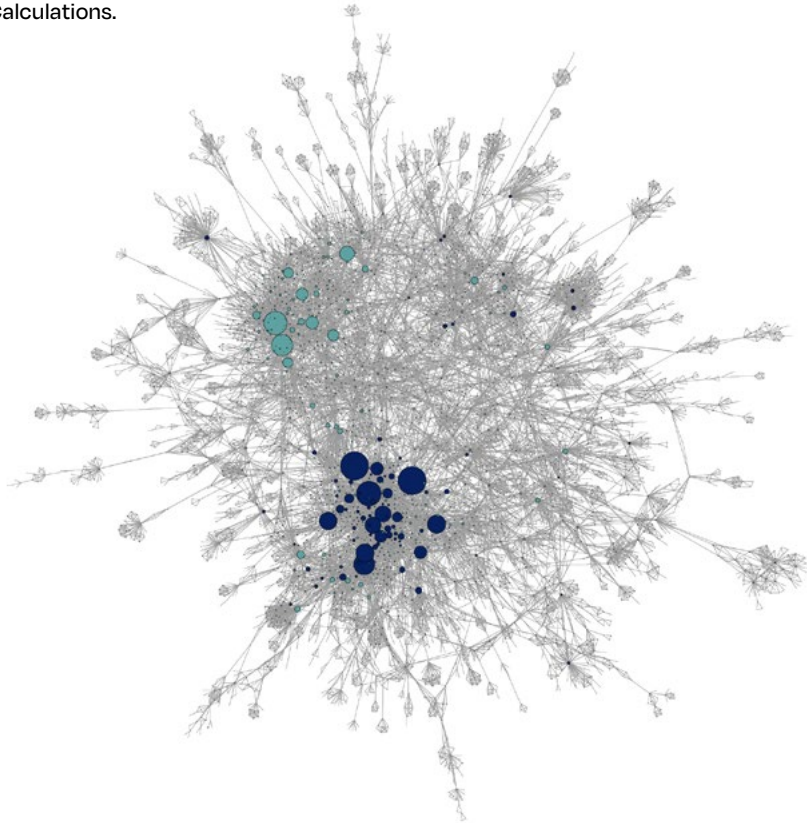


Figure 24: Population Health Researchers with Cleveland Connections. PubMed, 2017–2022. Author's Calculations.

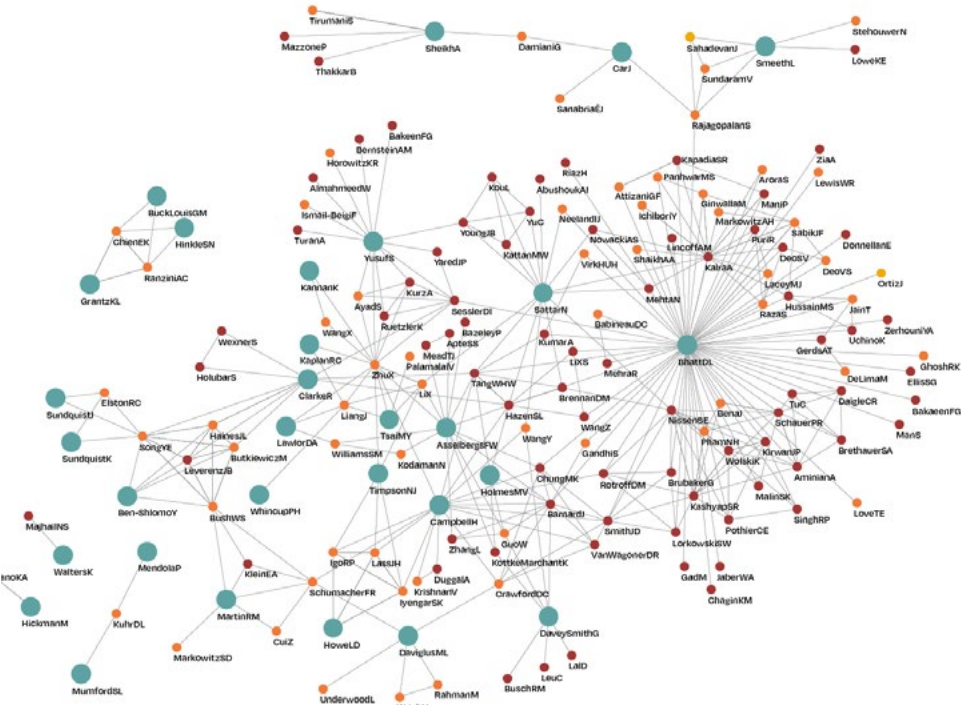


Figure 25: Population Health Researchers with Cleveland Connections. PubMed, 2017–2022. Author's Calculations.

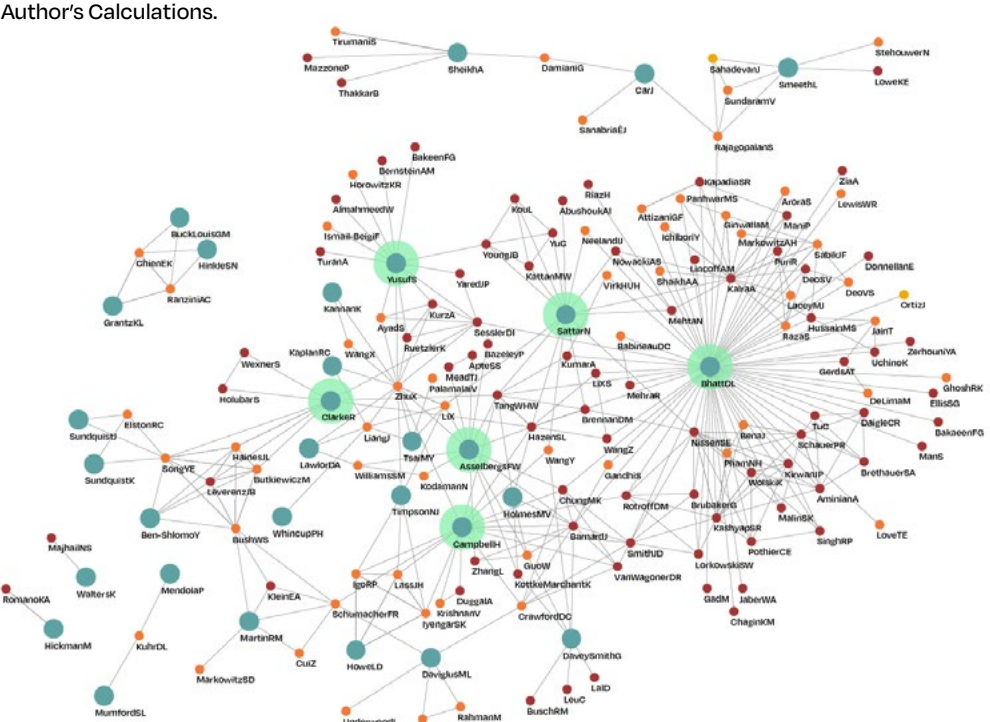


Figure 26: Cleveland Population Health Researchers with Star Scientist Connections. PubMed, 2017–2022. Author's Calculations.

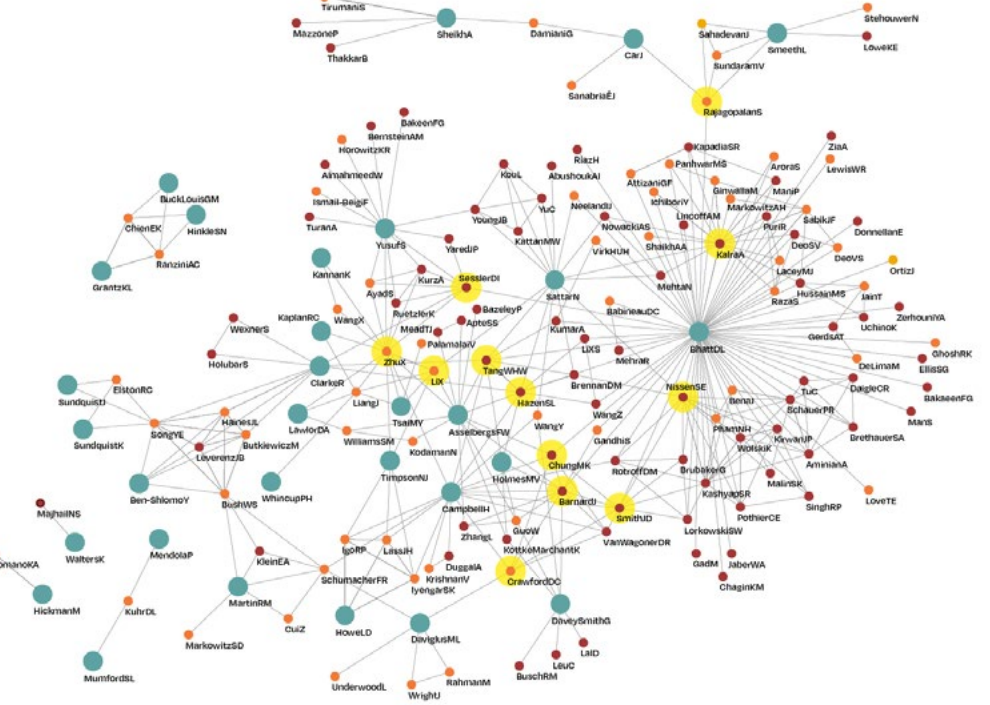
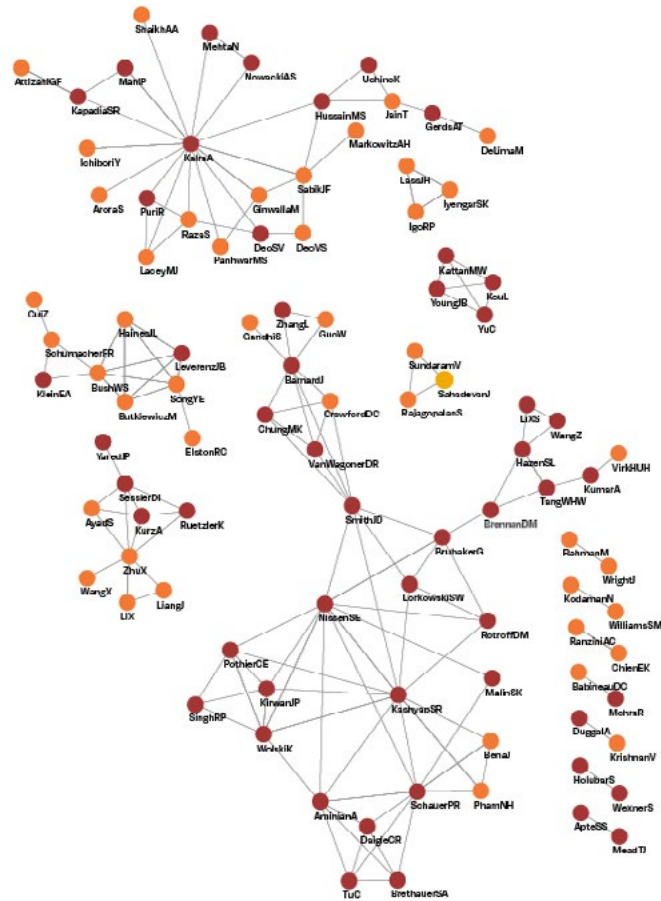


Figure 27: Cleveland Population Health Researcher Ecosystem. Source: PubMed, 2017–2022. Author's Calculations.



Park naturalists and children hiking in the Cleveland Metroparks, 1975
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

Let's keep going. *Figure 24* identifies who the population health researchers are from *Figure 23* with Cleveland ties and who they are collaborating with in Cleveland. Cleveland research scientists are shown as circles, with the color designating institutional affiliation: orange (●) for University Hospitals/Case Western Reserve University (UH/CWRU), red (●) for Cleveland Clinic Foundation (CCF), and light orange (●) for Veterans Affairs Medical Center (VAMC). The well-connected researchers outside of Cleveland are shown as larger aqua (●) circles. We see that some non-Cleveland-based scientists have many more connections into Cleveland than others.

Figure 25 identifies who those well-connected scientists are. A bright green (●) circle is drawn around those population health star scientists that are well embedded amongst Cleveland researchers. Consider these scientists prime targets for recruitment into Cleveland. Think of it as a precision strategy — not just brain gain but brain gain with a bang and with a purpose.

Figure 26 is the inverse to the same strategic thinking. It highlights which Cleveland population health star scientists have many connections to the highly-networked researchers we discovered in *Figure 24*. The Cleveland scientists are emphasized by a yellow circle (●) around their node and name, and they are integral in the execution of making Cleveland a center of excellence in population health research. Their work should be applauded and funded. If Cleveland were to lose these researchers, consider it brain drain with a bang.

Lastly, *Figure 27* shows just the Cleveland-based population health researchers without the external connectors. The intent of this map is to examine the extent population health research is being done in silos locally: a death knell to innovation, as boundary-spanning is important for a resilient and innovative research community. orange (●) for UH/CWRU, red (●) for CCF, and light orange (●) for VAMC. There are no research silos in this map. All three institutions collaborate with each other in the population health space. Cleveland is thus seeded with potential. Investing just right could kick off a bloom of outcomes that ultimately land in the breadbasket of Cleveland's well-being.

Act VII:

How does a city measure success? Commonly, success is measured as indicators of civic pride. How many Fortune 500 companies does a city have? How many championships? How big is your population? While these metrics are lauded by boosters and chambers of commerce alike, it is largely the stuff of “locker room talk”: more hubris than helpful. That’s because, beyond indicators of civic pride, a city’s success can be measured tangibly: in the number of small businesses opened or closed, in the number of jobs gained or lost, in dollars on citizenry paystubs and in hours on workers’ punch clocks. And then further downstream from these market forces, socioeconomic effects get played out. Think of socioeconomic — or the discipline that studies how economic activity shapes (and is shaped by) social processes — as where money meets mood. Because while the discipline is formally measured by means-tested stats like median wage, poverty rate, and household income, those figures are but an abstraction to the blossom of ways money either gets you in on the American entrée or puts you out.

To that end, socioeconomic is not only linked upstream to market factors, (*Where are the jobs? What are the qualifications? What’s the pay?*) but it also proceeds downstream toward human factors. Imagine our economic system as having an exerting, compounding effect on the quality of daily life, either crushing or enriching, civil society. Is our economic system working in a way that provides fertile ground for care? Or are we scorpions in a bottle?

To the extent it does or doesn’t, too, can be measured. On the downside, there’s a city’s incidences of trauma, addiction, hunger, infant mortality, assaults, chronic disease, etc. On the plus side, there’s the frequency of healthy births, good eating, pre-K enrollment, graduation, donation, public art, recreation, etc. Here, a city’s success gets measured viscerally at the level of gristle and bone, with the quality of daily living ultimately manifest in the geography of the body. This is where the rubber meets the road when it comes to a city’s success. After all, the body is the wellspring from all which is collectively won or lost. It is the first and last home. The first and last stop on the track. It’s where everything that’s moving rests, and it’s where everything that’s dormant gets going: change, progress, and hope. The key, here, is to realize that what settles at the bottom often flows from the top. This, in a nutshell, is the importance of policymaking.



Group of boys prepare to race, 1961
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

The Takeaway

Which brings us back to the heart of this paper. Up “top,” in this respect, examines the Cleveland model going forward when it comes to economic and community development through the lens of innovation and technological advance. The results uphold a rather basic strategic frame.

If COVID affirmed anything, it’s that the economy is inseparable from health. Without health, economic development isn’t possible, let alone equitable economic development. While we are still feeling the impact of the pandemic, it is an appropriate time to disrupt convention and put in place policies that fundamentally reimagine healthcare and health outcomes in Cleveland. Strategies going forward must fix root causes. Policies are needed to empower said strategies. The endgame, here, is not yet another economic development policy with well-being as a hoped-for byproduct. The endgame is better health in Cleveland. In fact, better population health is an economic development policy, if not the only economic development policy that is needed right here, right now.

Appendix A:

Source: Author’s Calculations

- 1. ‘0.026*”study” + 0.021*”risk” + 0.013*”health” + 0.012*”population” + ‘0.012*”aim” + 0.010*”high” 0.010*”outcome” + 0.009*”increase” + ‘0.009*”factor” + 0.009*”effect”’),
- 2. ‘0.019*”mechanism” + 0.015*”understand” + 0.015*”function” + ‘ ‘0.014*”molecular” + 0.012*”study” + 0.012*”aim” + 0.011*”role” + ‘ ‘0.010*”identify” + 0.010*”specific” + 0.008*”process”’),
- 3. ‘0.129*”gene” + 0.078*”genetic” + 0.044*”mutation” + 0.040*”dna” + ‘0.039*”expression” + 0.029*”genomic” + 0.028*”sequence” + 0.025*”identify” ‘+ 0.024*”genome” + 0.023*”rna”’),
- 4. ‘0.109*”brain” + 0.023*”neural” + 0.023*”disorder” + 0.023*”cognitive” + ‘0.023*”neuronal” + 0.021*”stroke” + 0.018*”behavioral” + 0.017*”functional” ‘+ 0.016*”deficit” + 0.015*”task”’),
- 5. ‘0.098*”infection” + 0.080*”hiv” + 0.039*”viral” + 0.036*”host” + ‘0.031*”lung” + 0.030*”virus” 0.025*”pathogen”+ 0.022*”infect” + ‘0.017*”disease” + 0.017*”asthma”’),
- 6. ‘0.137*”drug” + 0.052*”pain” + 0.042*”compound” + 0.036*”opioid” + ‘0.030*”alcohol” + 0.025*”treatment” 0.025*”tobacco” + 0.024*”food” + ‘0.021*”dose” + 0.021*”addiction”’),
- 7. ‘0.066*”obesity” + 0.063*”metabolic” + 0.052*”cardiovascular” + ‘0.052*”prostate” + 0.050*”metabolism” + 0.049*”metabolomic” + 0.043*”liver” ‘+ 0.033*”mitochondrial” + 0.030*”cardiac” + 0.029*”heart”’),
- 8. ‘0.048*”patient” + 0.034*”care” + 0.034*”clinical” + 0.031*”trial” + ‘0.022*”treatment” + 0.020*”intervention” 0.019*”improve” + 0.017*”base” + ‘0.015*”health” + 0.012*”outcome”’),
- 9. ‘0.022*”cell” + 0.017*”aim” + 0.017*”mouse” + 0.012*”induce” + 0.012*”model” ‘+ 0.011*”target” + 0.011*”signal” + 0.010*”determine” + 0.010*”study” + ‘0.010*”test”’),
- 10. 10 ‘0.339*”trainee” + 0.086*”university” + 0.086*”education” + ‘0.048*”postdoctoral” + 0.035*”diversity” + 0.027*”participation” + ‘0.021*”postdoctoral fellow” + 0.020*”emphasize” + 0.019*”junior” + ‘0.016*”enrichment”’),
- 11. ‘0.193*”protein” + 0.070*”bind” + 0.030*”structure” + 0.028*”membrane” + ‘0.025*”structural” 0.024*”complex” + 0.018*”domain” + 0.016*”receptor” + ‘0.015*”enzyme” + 0.014*”molecule”’),
- 12. ‘0.175*”age” + 0.124*”ad” + 0.059*”disease” + 0.043*”alzheimer” + ‘0.042*”dementia” + 0.033*”older_adult” 0.025*”cognitive” + ‘0.021*”pathology” + 0.021*”brain” + 0.021*”adrd”’),
- 13. ‘0.119*”neuron” + 0.053*”synaptic” + 0.052*”circuit” + 0.043*”behavior” + ‘0.042*”activity” + 0.038*”sensory” + 0.034*”motor” + 0.022*”input” + ‘0.020*”cortical” + 0.018*”plasticity”’),
- 14. ‘0.235*”cancer” + 0.107*”tumor” + 0.034*”patient” + 0.032*”breast” + ‘0.025*”therapy” + 0.021*”treatment” 0.020*”resistance” + 0.019*”target” + ‘0.016*”clinical” + 0.015*”metastasis”’),

Top 20 Rank of Cleveland’s R&D Funding by Topical Cluster

- 15. ‘0.082*”birth” + 0.056*”requirement” + 0.033*”net” + 0.028*”spectral” + ‘0.027*”exploration” + 0.024*”kinetic” + 0.022*”walk” + 0.021*”rotation” + ‘0.018*”light” + 0.016*”color”’),
- 16. ‘0.110*”sleep” + 0.088*”channel” + 0.037*”injection” + 0.032*”terminal” + ‘0.020*”excitability” 0.018*”ion_channel” + 0.017*”identical” + ‘0.016*”rhythm” + 0.012*”motif” + 0.012*”urgently needed”’),
- 17. ‘0.171*”child” + 0.055*”pediatric” + 0.044*”asd” + 0.042*”infant” + ‘0.037*”pregnancy” + 0.035*”family” + 0.035*”maternal” + 0.033*”parent” + ‘0.031*”youth” + 0.028*”development”’),
- 18. ‘0.342*”cell” + 0.072*”immune” + 0.043*”response” + 0.023*”cd” + ‘0.021*”antibody” + 0.020*”type” + 0.019*”antigen” + 0.016*”specific” + ‘0.015*”immunity” + 0.011*”melanoma”’),
- 19. ‘0.029*”datum” + 0.024*”develop” + 0.019*”model” + 0.018*”use” + ‘0.017*”project” + 0.016*”analysis” + 0.013*”method” + 0.011*”new” + ‘0.011*”study” + 0.010*”provide”’),
- 20. ‘0.060*”research” + 0.035*”program” + 0.023*”training” + 0.022*”core” + ‘0.018*”support” + 0.016*”provide” + 0.013*”center” + 0.011*”clinical” + ‘0.011*”include” + 0.011*”investigator”’)]

Index

- i** <https://www.jobsohio.com/news-press/jobsohio-university-of-cincinnati-and-cincinnati-childrens-unveil-the-cincinnati-innovation-district/>
- ii** <https://governor.ohio.gov/media/news-and-media/cleveland-innovation-district-01252021>
- iii** https://en.wikipedia.org/wiki/Capitalism,_Socialism_and_Democracy
- iv** <https://www.nationalreview.com/2019/11/the-case-for-common-good-capitalism/>
- v** <https://languages.oup.com/google-dictionary-en/>
- vi** <https://mitsloan.mit.edu/ideas-made-to-matter/what-microsofts-satya-nadella-thinks-about-work-future>
- vii** https://en.wikipedia.org/wiki/General-purpose_technology
- viii** <https://www.nytimes.com/2021/02/23/technology/ai-innovation-privacy-seniors-education.html>
- ix** <https://www.cdc.gov/socialdeterminants/index.htm>
- x** <https://www.jontaplin.com/move-fast-and-break-things>
- xi** <https://www.nytimes.com/2022/01/26/opinion/covid-biden-trump-polarization.html>
- xii** Economic output is measured by Gross Domestic Product (GDP), which is the total value of goods produced and services provided.
- xiii** <https://books.google.com/books?id=DFEEAAAAMBAJ&lpg=PA123&dq=metcalfe%20info%20world%20silicon%20valley&pg=PA123#v=onepage&q&f=false>
- xiv** <https://www.nytimes.com/2020/11/28/us/tony-hsieh-las-vegas.html>
- xv** <https://monroeengineering.com/blog/what-is-advanced-manufacturing/>
- xvi** https://en.wikipedia.org/wiki/Internet_of_things
- xvii** <https://www.wsj.com/articles/SB10001424053111903480904576512250915629460>
- xviii** <https://www.washingtonpost.com/outlook/2020/03/27/economic-efficiency-resilience-coronavirus/>
- xix** <https://www.cleveland.com/open/2019/10/sen-sherrod-brown-hopes-to-hear-his-dignity-of-work-message-at-ohios-debate.html>
- xx** <https://www.nytimes.com/1970/09/13/archives/a-friedman-doctrine-the-social-responsibility-of-business-is-to.html>
- xxi** <https://hbr.org/2015/06/the-great-decoupling>
- xxii** http://www.koreatimes.co.kr/www/biz/2017/11/367_239312.html

- xxiii** https://www.brookings.edu/wp-content/uploads/2021/02/Technology-growth-inequality_final.pdf
- xxiv** <https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-in-black-america>
- xxv** <https://www.nytimes.com/2022/01/11/technology/income-inequality-technology.html#:~:text=Half%20or%20more%20of%20the,some%20of%20his%20recent%20research.>
- xxvi** <https://truthout.org/articles/financialization-has-turned-the-global-economy-into-a-house-of-cards-an-interview-with-gerald-epstein/>
- xxvii** <https://jamanetwork.com/journals/jama/article-abstract/2756187>
- xxviii** https://engagedscholarship.csuohio.edu/urban_facpub/1748/
- xxix** https://engagedscholarship.csuohio.edu/urban_facpub/1748/
- xxx** Source: Longitudinal Employment Household Statistics, LEHD, 2016
- xxxi** <https://www.brookings.edu/essay/rise-of-innovation-districts/>
- xxxii** <https://www.clevelandfed.org/newsroom-and-events/publications/annual-reports/ar-2005-perspective-on-75-years-of-state-income-growth/ar-200502-altered-states-essay.aspx>
- xxxiii** <https://ineighborhoods.us/innovation-districts/#:~:text=Innovation%20Districts%20are%20geographic%20areas,housing%2C%20office%2C%20and%20retail.>
- xxxiv** https://www.google.com/books/edition/Escaping_the_Progress_Trap/DrvcDwAAQBAJ?hl=en
- xxxv** <https://www.theverge.com/2022/1/22/22895447/intel-ohio-chip-fab-manufacturing-cpu-processor-explained>
- xxxvi** <https://arxiv.org/ftp/arxiv/papers/2201/2201.04200.pdf>
- xxxvii** <https://arxiv.org/ftp/arxiv/papers/2201/2201.04200.pdf>
- xxxviii** https://engagedscholarship.csuohio.edu/urban_facpub/1518/
- xxxix** <https://academic.oup.com/icc/article/27/5/803/5127692>
- xl** <https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm>
- xli** <https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm>
- xl** <https://lithub.com/margaret-omara-silicon-valley-is-as-american-as-apple-pie/>
- xl** <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/building-an-r-and-d-strategy-for-modern-times>
- xliv** OECD (2022), Gross domestic spending on R&D (indicator). doi: 10.1787/d8b068b4-en

Index

xlv <https://en.yna.co.kr/view/AEN20210512001400320>

xlvi https://tulsaworld.com/opinion/columnists/noah-smith-heres-how-universities-can-make-their-cities-great/article_e651f4a9-852a-56a3-ba2e-ae12d8826737.html

xlvii https://engagedscholarship.csuohio.edu/urban_facpub/1742/

xlviii Note: Baltimore and Washington, DC were excluded for data reporting irregularities.

xlx <https://wayback.archive-it.org/18816/20220223125200/https://federalreporter.nih.gov/FileDownload>

I https://en.wikipedia.org/wiki/Topic_model#:~:text=In%20machine%20learning%20and%20natural,structures%20in%20a%20text%20body.

li <https://neo-trans.blog/2021/10/15/cleveland-clinic-to-massively-expand-its-facilities/>

lii <https://neo-trans.blog/2021/05/18/new-pathogen-center-heralds-start-of-innovation-district/>

liii <https://www.uhhospitals.org/services/genetic-services>

liv <https://sciences.csuohio.edu/cmms/cmms>

lv <https://par.nsf.gov/servlets/purl/10098435>

lvi <https://par.nsf.gov/servlets/purl/10098435>

lvii <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7468461/>

lviii https://www.clevelandjewishnews.com/features/health/hall-named-first-medical-director-of-uh-cutler-center-for-men/article_553ad5bc-7561-11ec-b7e7-afcf8159287e.html

lix https://www.researchgate.net/publication/254746540_Mobile_star_scientists_as_regional_knowledge_spillover_agents

lx <http://orgnet.com/sna.html>

lxi <https://pubmed.ncbi.nlm.nih.gov>

back cover: Lake in Rockefeller Park
Image: courtesy of The Bowden Postcard Collection Online c/o Miami University Libraries - Digital Collections

Euclid Avenue, Looking East, Cleveland, Ohio, 1900-1929
Image: courtesy of the Michael Schwartz Library Special Collections, Cleveland State University

in Rockefeller Park, Cleveland, Ohio.

DIS-
INNO-
RUPTING
VATION