HOW PITTSBURGH CAN BUILD A BETTER INNOVATION AND EMERGING-TECHNOLOGY ECONOMY THROUGH CONNECTIVITY, DENSITY, AND COLLABORATION

P.A.R.T.
PARTNERSHIP TO ADVANCE RESPONSIBLE TECHNOLOGY

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EXECUTIVE SUMMARY

How Pittsburgh Can Build a Better Innovation and Emerging-Technology Economy through Connectivity, Density, and Collaboration

With support from the Richard King Mellon Foundation, the Partnership to Advance Responsible Technology (commonly referred to as PART) conducted a one-year study to better understand which organizations and initiatives in the Pittsburgh region are seeking to grow the innovation and emerging-technology ecosystem, and more importantly, where the region may still be missing out on readying itself to capture new opportunities.

As one can imagine, this ecosystem is broad, diverse, complex, and multi-faceted. To that end, PART focused both on larger organizations that have substantial impact and influence on the region's innovation and emerging-technology ecosystem (for a variety of reasons, such as financial, political, historical legacy, or some combination thereof), as well as smaller start-up or nontraditional entities with the potential to start—or continue—making dramatic progress in the region. For the sake of clarity, our focus was across public, private, nonprofit, and the academic sectors, and dozens of sub-industries within.

PART's ultimate goal was to better understand the local ecosystem's machinations and make tangible recommendations about how to capitalize on current and future opportunities— specifically around growing the innovation and emerging-technology economy in general, and doing so responsibly with inclusiveness and accessibility in mind. Early in this project, and partly fueled by the evolving ramifications of the global COVID-19 pandemic, PART quickly realized that a traditional audit or inventory of assets and gaps only told part of the story. In reality, any innovation and emerging-technology economy, but specifically one like Pittsburgh's with such prowess and potential, needed to comprehend how to better build connectedness, density, and collaboration. Only economies that are efficiently and effectively connected, have dense composition of its human, financial, and organizational assets, and have a multi-sectoral, collaborative nature—all bonded together with an overarching unified strategy—will lead the future.

PART found in several instances that multiple Pittsburgh assets are indeed quite capable of spurring current or future growth either through direct leadership or through some form of partnership capacity building. However, our research also uncovered many times where the region has duplicative or competing efforts; rough, winding, or broken pathways amongst organizations, individuals, or initiatives; or put simply, one entity assumed another entity was taking charge and nothing was actually being accomplished.

Ultimately, when Pittsburgh's local economy for whatever reason may not be properly equipped to initially develop a solution for growth or missed opportunity, PART also strove to consider how strategically erecting external regional partnerships (for example, with other cities) might help Pittsburgh grow or be competitive in the future.

Premier: Assumptions, Challenges, and High Stakes (and Opportunities)

Other studies and analyses about Pittsburgh's innovation and emerging-technology ecosystem have astutely identified where the region has taken historical steps to position itself for potential progress. In addition, many of these same studies have also described where subsequent growth is hindered by a region that is siloed, diffuse, or unfortunately working in ways unrelated to healthy, competitive market forces. Oftentimes these ideas hold assumptions and exist as challenge-identification exercises without a solution that better aids Pittsburgh to build a premier innovation and emerging technology economy.

How can Pittsburgh better build such an economy? As our research indicates, there is no single answer to this question. Moreover, there are many different angles, elements, or relative definitions to this question that deserve more comprehensive research and go beyond the scope of PART's work on this single project. To be sure, many years can be spent unpacking and analyzing how a major American city's innovation and emerging-technology ecosystem can best grow, prosper, and contribute meaningfully to the world. Yet the Pittsburgh region hardly has this time as a luxury—we must, as the adage goes, "build the plane while we fly it."

Through this work, PART has identified several potential strategic and tactical approaches that can help the region grow and develop into a premier ecosystem. And what do we mean by "premier" in the first place? In short, Pittsburgh must:

01 Be a global leader across multiple technical industries;

02 Employ a significant portion of its workforce in the advanced technology or technology-adjacent sectors (i.e. 25% or more);

03 Invest multiple billions of dollars through venture capital and venture philanthropy into high-grow industries, annually;

04 Scale and grow new companies and entrepreneurial ventures across sectors at an accelerated rate, and;

05 Recruit, develop, and retain tens of thousands of new, tech-skilled workers, annually.

Without a shadow of a doubt, the cornerstone of this effort is based upon connectivity, density, and collaboration. Without these three elements, the region is fighting a losing battle.

So why does this matter? What happens if Pittsburgh does in fact come up short and miss opportunities? Are the consequences real? Yes, and the stakes are high, too. According to a myriad of research, the present decade will usher in dramatic change to the social and economic landscape of our country, with mid-level, postindustrial cities like Pittsburgh most vulnerable to seismic shifts. Ironically, this change is driven by the very emerging technology that Pittsburgh's innovation economy (1) produces — artificial intelligence, machine learning, advanced robotics, additive manufacturing, and much more. As an umbrella term to aggregate a significant part of the collective impact of these emerging technologies, 'automation' can and will present a host of compelling opportunities for the region. Advances in such automation have the capability to directly threaten or simply eliminate more than half of the jobs within the Pittsburgh region. Similarly, nearly 40 years ago, Pittsburgh lost half of its workforce (and population) during what is euphemistically referred to as "Rock Bottom"—the nadir of heavy manufacturing in the region. The last four decades have been a long road to recovery, marked by tremendous courage, experimentation, and affiliated success, but also stark in disparity, inequity, and division. With this dichotomy in mind, Pittsburgh nevertheless still remains a national success story to celebrate. Yet, if we collectively do not make a heroic effort to better build an innovation and emerging-technology ecosystem, all of the efforts of nearly 40 years are threatened.

What remains as a generally recognized truth throughout research is that the Pittsburgh region simply must undertake a dramatic transformation of its economy, politics, and demographics to meet the new and rather unforgiving demands of the "21st Century" economy increasingly defined by rapidly evolving, scalable technology and the inherent pressure that significant change places on virtually all elements of our daily lives.

If Pittsburgh does capture the moment, the opportunities are limitless. PART imagines a premier economy that is inclusive, accessible, equitable, growth-oriented, flexible, groundbreaking, and above all, responsive to change. Hundreds of thousands of people who were at risk of being left behind are meaningfully employed in sustainable growth industries in said economy. New job creation abounds. Access to growth capital widens. The region's tax base increases. Quality of life improves. Housing stock grows. Students stay. Sociopolitical dynamics evolve and refine. Minority, immigrant, and LGBTQIA+ communities are heavily represented in innovation and emerging-technology ecosystems. Our institutions evolve into examples of new national leadership and unveil an era of public-private partnership that can positively define the next 100 years. Without collaborative efforts — both large and small, including the recommendations within this research put forth by a multitude of stakeholders—we are essentially leaving the region's fate to chance.

1.The terms "innovation" and "emerging-technology" are commonly used today to describe economies across the globe, but we recognize that definitions vary across sector, industry, or even city or country. PART subscribes here mostly to characteristics as defined by PitchBook, a widely-used reference to track business developments. PitchBook notes that "Emerging technologies represent growing areas of technological innovation that attract capital for their disruptive, thematic, or secular growth potential." Further, PitchBook groups technology classes and provides research reporting in areas such as Agtech, Artificial Intelligence and Machine Learning, Cloudtech and DevOps, Enterprise Health and Wellness Tech, Fintech, Foodtech, Information Security, Insurtech, Internet of Things (IoT), Mobility Tech, Retail Health and Wellness Tech, and Supply Chain Tech. PART extends this list to include many other areas including but not limited to, EdTech, Data Science, and Bio and Life Sciences, and the adjacent, supporting industries such as legal, accounting, finance, media, and others. In essence, PART strives to be as inclusive as possible of many macro and micro themes that constitute the great research, development, deployment, and governance of technology across the Pittsburgh region.

Study Parameters

PART gathered data from 200 participants: 112 in-depth interviews and 88 long-form surveys helped us understand and comprehend what it truly feels like on the ground participating in the local innovation and emerging-technology economy. As an independent non-profit organization, PART committed to establishing a safe space to anonymously and objectively listen to participants and discover what keeps them here and pushes them forward, and crucially, what pain points are hampering or disrupting world-class growth trajectories, or even pushing regional players to consider leaving the regional, altogether. Building off other reports by the Brookings Institution, Innovation Works, the Allegheny Conference on Community Development, and many others, our study augments and complements the quantitative analysis about our region with unprecedented qualitative context, shedding light on where we are now and what it takes to propel us successfully into the future.

Core Themes

Our analysis points toward five themes where we uncovered the need for creative solutions:

CAPITAL:	Pittsburgh must cultivate capital channels appropriate for an innovation economy and better manage funds in the ecosystem
LEADERSHIP:	Pittsburgh must create intentional and inclusive cross-generational and cross-cultural leadership development programs
EDUCATION & TALENT:	Pittsburgh must invest in broad technology education and expand workforce development programming
REGIONAL & NATIONAL STRATEGY:	Pittsburgh must design a well-communicated regional and national technology economy strategy
METRICS & DATA:	Pittsburgh must maintain leading organizations with transparent metrics and are strong with data sharing and archiving

Within each theme PART suggests several tangible recommendations; but this is not a comprehensive list of needs, nor will addressing this list rectify all challenges and capture all opportunities presented to the region. Deploying creative solutions in these spaces is, however, a dramatic and much-needed start, and based on data from some of the most widely knowledgeable and respected individuals possible in the innovation and emerging-technology economy.

In each of these thematic areas, we found fractures of opinion, operating fissures, and gaps of awareness about current activities as well as an interconnection to focal problems retarding growth, collaboration, and innovation. Basically, this research proves these issues are symptoms of a larger condition.

Solutions-Focused

By combining insights from our participants, studying external regions, and leveraging the deep knowledge base contained at PART, we offer a set of potential solutions to these challenge areas. Some recommendations require a level of contextualization, while others simply stand alone. Relevant throughout our research is the need to aggressively retain more young and diverse talent in the region. The current unfavorable numbers around young and diverse populations were found to be linked to our aforementioned list:

01 **Difficulty accessing capital;**

02 **Low ceilings of leadership opportunity;**

03 **Poorly communicated strategies about how the region intends to grow, and;**

04 **Opacity around data and metrics that justify our current investments and activities.**

Furthermore, our findings indicate it is clear that Pittsburgh and its leaders and citizens can share in a host of exciting opportunities by better understanding both the local region, as well as other regions, including:

01 **Robust connection to other technology economies for acceleration and incubation;**

02 **Increased capital pools;**

03 **Talent recruitment, and;**

04 **Business development, attraction, and retention.**

PART further suggests a set of strategic investments and realignments of current programmatic work meant to better position the innovation and emerging-technology economy for higher growth. Specifically, for example, our data suggests a need to increase available technology accelerator programs; concerted efforts to increase the availability of risk-tolerant capital; more forums and programs that inform current leaders and invest in young leaders emphasizing cross-generational and cross-cultural connectivity; strong and well-communicated metrics; better data collection infrastructure; and broad investments in technology education—particularly in our K-12 system and predominately minority communities.

While we have many great assets in our region that offer a platform or path for potential growth, the widely held sentiment is that the city overemphasizes and invests in our known strengths and legacy institutions, perpetuating an element of status quo, while continuing to overlook the growing weaknesses and inability to generate new energy and talent.

PART and the many cross-sector leaders and citizens represented in this report believe there are immediate actions we can take as a region to better connect and align us toward our most promising future of growing a premier, earth-shattering innovation and emerging-technology economy, and we hope this report serves as a catalyst for candid conversations about how to do so in an inclusive, equitable, and forward-thinking manner.

SECTION 1: OVERVIEW OF STUDY

Purpose

This study was originally catalyzed by ongoing conversations occurring between the cities of Pittsburgh, Boston, and Montreal about the potential formation of a regional partnership around the artificial intelligence (AI) industry, an effort informally denoted at the time as the "AI Triangle." During these multiple initial conversations, the majority of which were organized by the Partnership to Advance Responsible Technology's (PART) seven co-founders, it became clear that Pittsburgh actually had several schisms about what the next step for the City and wider-region's technology economy should be or look like. For some, developing a multi-city strategy was a wedge issue that could undersell what the region already had to offer; whereas others were overtly desperate for connectivity to outside resources, ideas, and energy.

This idea dovetailed with additional conversations PART had been having as part of its mission and key organizational initiatives about what gaps may threaten the long-term competitive position of the City, and what vital ingredients should be added to boost the technology sector's connectivity and performance as a whole.

Across these parallel discussions, questions constantly emerged about Pittsburgh's readiness to engage in regional partnerships; whether City leadership was either aware of its potential or being honest about the health of the sector (much less equipped with tools and information to directly help); and how Pittsburgh could improve as a fertile location to grow or recruit new technology businesses, especially in the burgeoning AI field.

With simple, anecdotal evidence that there were vast differences in opinions and visions, PART established a formal research agenda to objectively engage stakeholders within our City and wider region to assess the health and preparedness of our technology sector and underlying infrastructure--both to determine if participation in a regional partnership should be a future strategic endeavor for Pittsburgh, but also how ready Pittsburgh is in general to chase after the emerging "white whale" that many other cities are trying to grapple with--building a "Technology Innovation Economy for the 21st Century."

Indeed, the onset of the COVID pandemic at the precise moment our study commenced slightly troubled our ability to deeply engage Boston and Montreal stakeholders even more (not only was travel off the table, but understandably municipal priorities shifted, and discretionary budgets seized up), but this actually provided PART with an opportunity to dive much deeper into our local economy, pivoting from more of a traditional inventory or audit into an assessment of connectivity, density, and collaboration.

The goal here was to develop a report that would answer these questions uniquely and in complementary fashion to prior reports done by the Brookings Institution, Innovation Works, and the Allegheny Conference on Community Development, amongst several others. Each of these reports address certain overlapping factors about the health of the technology economy in the Pittsburgh region. And each of these reports were developed with a specific charge or organizational perspective as to what is important to our future growth and success potentials.

Put simply, numbers may or may not tell us whether a particular ecosystem strategy is right; operators and folks trying to build businesses can.

Rather than attempting to paint a picture of the region using economic estimates or showcasing particular statistical trends—many of which are difficult to address at varying level of abstraction—we focused on a qualitative approach that provides context to known data. Put simply, numbers may or may not tell us whether a particular ecosystem strategy is right; operators and folks trying to build businesses can. PART sought to know what it feels like to be part of this technology economy directly; what are the actual tangible or intangible hurdles entrepreneurs face; what are we doing right; and ultimately, identify a solution space to capture opportunity (e.g., why is it that we find young people and diverse people not attracted to come or stay Pittsburgh? How can we change that?)

To accomplish this, we set our research goals as follows:

01 **Cast a wide net:** Interview and survey as many distinct stakeholders across sectors, industries, and unique organizations as possible relevant to the innovation and emerging-technology economy.

02 **Analyze Strengths:** Determine the most potent advantages of starting, operating, or growing a technology business in the Pittsburgh region.

03 **Understand Pain Points:** Articulate the major issues holding back the growth of talented individuals and technology companies in our region.

04 **Identify Critical Factors to Establish Context:** Using trend-based analysis and a deep review of all data, we look to find the most important factors that are corresponding to the pain points that are not resolved by the strengths and point toward specific needs. By grouping common factors raised by participants, we attempted to illustrate the felt context extant around certain problem spaces.

05 **Determine Solution Space:** Using a mixture of insights offered by participants and ideas that emerged from analyzing our data set, we look to offer a set of possible solutions for seizing opportunities and taking the right next steps to grow the region's technology economy and be a competitive innovation economy in the coming decades.

The Partnership to Advance Responsible Technology (PART)

PART is well-positioned to take on this project for a variety of reasons.

Primarily, as a Pittsburgh-based nonprofit organization, PART was founded and is governed by a team of interdisciplinary experts such as AI researchers, technology ethicists, legal consultants, and professionals working in areas such as autonomous systems, policy, education, and other places in the business and nonprofit spectrum. We bring not only a unique and well-informed set of knowledge, skills, and abilities to each of our engagements, but a purposefully collaborative approach.

Beyond this, and most importantly, our Board of Directors, Staff, Advisors, and Volunteers are deeply embedded in the local (and global) community of engineers, researchers, business leaders, and public officials. While PART has no top-down direct affiliation to any individual or particular organization that currently "shapes" the region, we are deeply knowledgeable of the region's stakeholders and efforts.

In other words, PART is nimble, objective, and above all, independent.

As a component of our mission—where we use research, education, and multi-sector stakeholder engagements to ensure the responsible development, deployment, and governance of emerging and data-driven technologies, notably artificial intelligence—we provide a unique platform to consciously foster partnership-capacity building and develop the driving factors of an innovation economy.

In practice, this goes beyond operationally "connecting the dots" or "cutting across silos" to provide information to decision makers and ensuring the efficient and effective deployment of resources.

> PART has ultimately created a safe and anonymous space for people to say what they feel is true without retribution or concern that they could be limiting their own opportunities in the city and region.

As a study participant who works in the Pittsburgh venture capital space noted to PART "every time I, or another one of my peers, tries to trumpet any validation, it seems self-serving. We shouldn't argue about facts, we need entities to support and tell us how it really is, and PART can help with that."

In the end, Pittsburgh and the surrounding region will undeniably benefit from having more safe spaces for open, honest dialogue like this without consequence. Additionally, this will propel the region's potential, and responsibly uncover the most opportunities for the most people.

PART aims to support this process.

Definitions

Here we convey key definitions of terminology we will use throughout the report. Much of the terminology around emerging technologies and economies are fluid so we want to be transparent about what we mean to avoid confusion going forward:

AI: Artificial intelligence is assemblages of technologies that, put into concert, allow for the completion of a task that would otherwise require a human-like intelligence to perform.

Machine Learning: A computational approach to developing a statistical model that can provide an intelligible and useful output that often equips a larger system with data-driven intelligence.

Technology Economy: The finite set of human, financial, and intellectual capital that is put toward the creation and growth of businesses that specialize in developing and implementing technological products and services.

Innovation Economy: The finite set of human, financial, and intellectual capital that is leveraged to research, test, and grow unprecedented ideas that reshape or disrupt solutions common to current public and private organizations; often using technological tools, though not necessarily.

Emerging Technologies: Digital and computational tools that are still in early phases of adoption; though are trending to displace or otherwise reframe what a certain industry may look like in the future (e.g., ML tools that automate and simplify frame-by-frame computer animation).

AI Innovation: The use of AI to reconstitute former processes, decisions, or services that leverage unprecedented combinations of human expertise, data, and computational intelligence, including but not limited to the deployments of Machine Learning breakthroughs.

Technology Talent: The targeted areas of human capital that catalyze and ameliorate the growth of innovation and technology economies. Including but not limited to skilled and demanded software developers, data analysts, designers, researchers, project/product managers, technically-literate sales associates, tech-savvy business leaders, and support organizations that accelerate this particular cluster of people and resources.

Technology Education: Curriculum and training that explicitly imbues the fluent use of technological tools into the growth of foundational and targeted skills. Technology education is used broadly to denote a spectrum of competencies that start with core literacies, such as typing skills and use of cloud storage/sharing to complete K-12 school projects, on one end and the training of highly specialized experts, such as computer vision engineers, on the other end. A region with “strong technology education resources” would be invested in educational assets across the entire spectrum.

Methods

Approach

To canvas diverse opinions in a variety of ways about the region's opportunities to connect better throughout the innovation and emerging-technology economy, PART developed two protocols: a semi-structured interview design for in-depth conversations, and a long-form online survey for a more flexible solicitation. Whereas our goal was to conduct as many interviews as possible, the surveys helped expand our reach and gain insights from those participants who were not able to give the time a proper interview required. The survey could be completed in 10-20 minutes, depending upon one's desire to provide supporting thoughts (which was almost universally given), and interviews ranged from 30-60 minutes; though in some instances many lasted several hours.

Leveraging the PART Board of Directors, Staff, and network of Advisors, Volunteers and others, PART identified several hundred individuals and organizations all knowledgeable and intimate with Pittsburgh's historical, current, and potentially future technology efforts. These individuals and entities were adjudicated by PART as either directly involved or adjacently supporting the innovation and emerging-technology economy. In particular, we prioritized entities and individuals who were building companies themselves or were facilitators in connecting the ecosystem to support innovation; even more specifically the spaces around AI innovation.

Our team constructed a multi-dimensional matrix to focus our efforts and capture data from the full spectrum of stakeholders:

01 The public, private, nonprofit, and academic sectors

02 Within each sector, individuals from organizations representing a variety of sub-sectors or industries (2)

03 Entities within the technology economy classified as either "direct" or "supporting" (3)

04 Individuals with varying levels of seniority (e.g. C-suite executives to entry-level employees)

05 Individuals with varying connections (i.e. individuals that may have multiple professional affiliations, such as a founder, venture capitalist, and professor)

06 Individuals with diverse backgrounds from a demographic standpoint.

2. For example, in the private sector, PART categorized various industry groups like life sciences, education, manufacturing, etc.
3. For example, PART considered "direct" participation as a technology start-up company founder or employee, while "supporting" participation would equate to providing venture capital, legal, accounting, consulting, or real estate services.

We did not purposefully exclude anyone from outside of the region. For example, an individual that is employed by a company located in Pittsburgh but currently lives in another city or state; or an individual that worked in the Pittsburgh region for an extended period of time, but recently relocated themselves or their business to another city or state (migration is a topic unto itself which we'll discuss later, and only made more interesting with the onset of the COVID-19 pandemic). We did, however, focus on the uniqueness of the participant, meaning that we targeted interviewing people across different organizations as opposed to interviewing many from a single larger entity, irrespective of the organization's influence.

Outreach was conducted in a variety of manners, such as email, phone call, text message, and social media direct messaging (e.g. LinkedIn, Twitter, Facebook). PART did not use any third-party help to solicit or perform outreach. PART also elected to not solicit input with "mass media" tactics; that is, we intentionally avoided social media postings and listserv e-blasts. We did so in an effort to not only keep data "clean", but we felt this particular study's importance required intimacy with the subject matter and a thoughtful way to convey it.

Privacy

Obviously in any research study, the privacy of participants is of utmost importance. Unfortunately, as was described earlier in this section, this was especially important to many participants for fear of personal or professional judgement.

PART staff dedicated to this project and its Board of Directors committed to the following policies regarding the handling and reporting of research data:

01 The interviewer(s) will take manual notes of interviews. By default, no recordings (audio or video) will be made of interviews, unless an interviewee indicates they do not mind being recorded.

02 All raw data provided by interviewees will be managed in private, password-protected cloud infrastructure or private computers of the research team.

03 PART will not share raw data or personally identifiable information with anyone outside of our research team, nor discuss details of interviews with anyone outside the organization.

04 Interview analysis will focus on identifying larger themes and issues to report in aggregate and will not attribute data to specific companies or people without permission.

05 PART will not quote any interviewee directly in research reports without written agreement by the interviewee and providing them an opportunity to modify the quote before reporting.

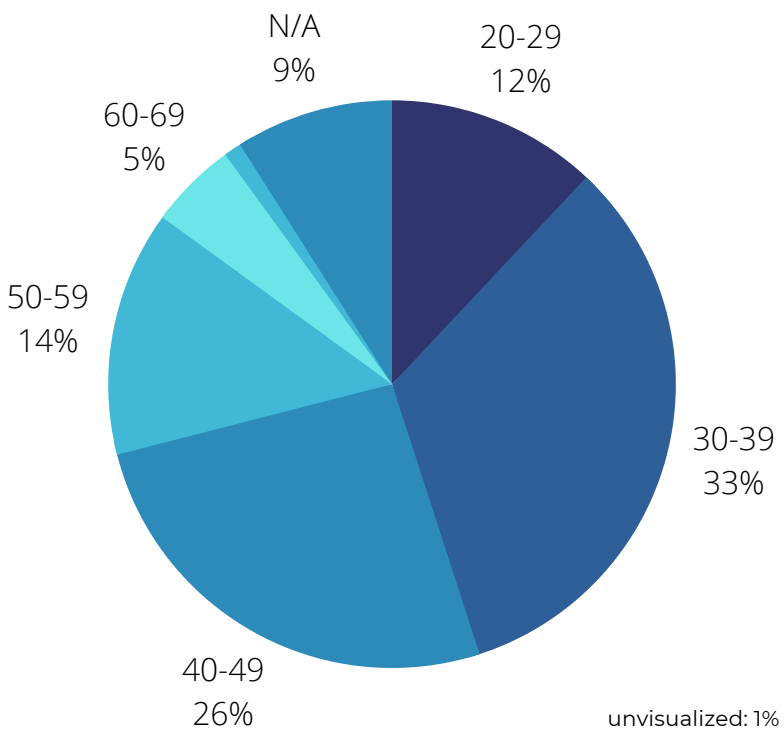
Resulting Data

The total sample size for this study is 200, with PART staff conducting 112 in-depth interviews either in person or via electronic platform (e.g. Zoom), as well as gathering 88 properly completed long-form surveys.

A brief summary notes that our sample population varied widely in age (i.e. 50 year range); ethnicity; gender-identification; academic accomplishments (i.e. high school graduates through doctorate-level completion, with several individuals holding multiple degrees); field of study (i.e. 75 distinct higher education and graduate level programs); and personal and professional endeavors (e.g. small business owners to complement full-time employment; nonprofit Board members; trademark and patent holders; published authors; and globally recognized musicians; amongst other achievements).

A breakdown of our general demographics is found below (4):

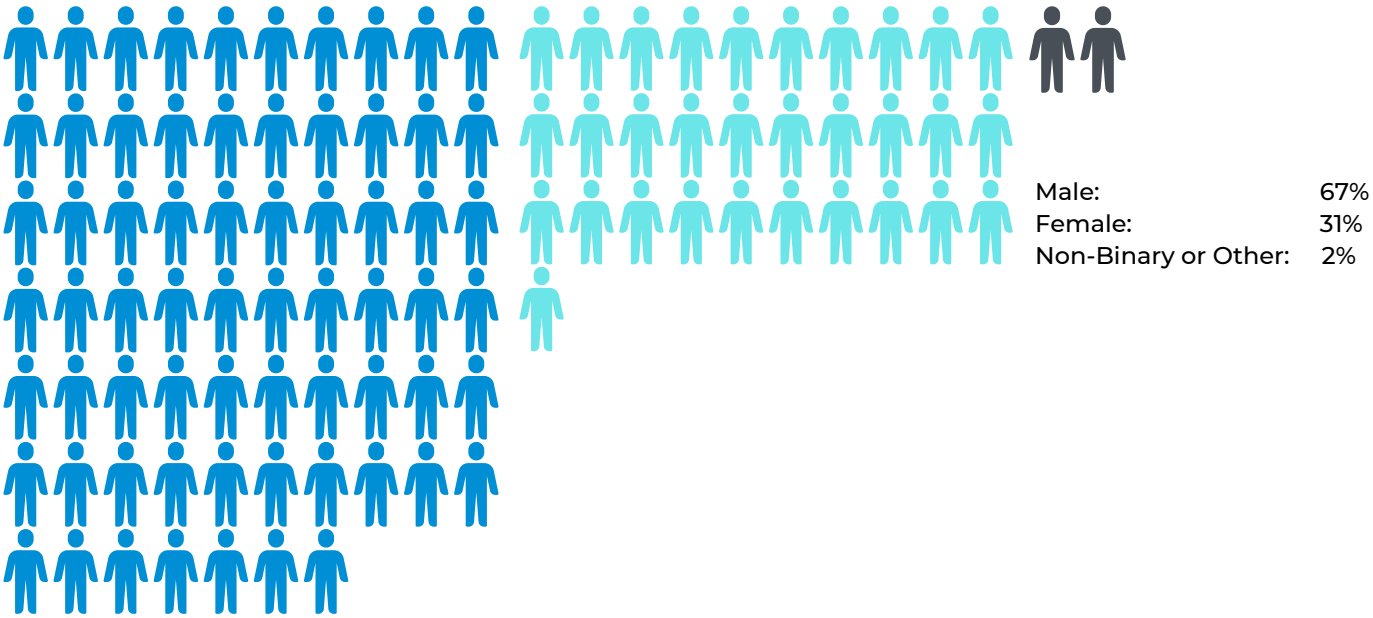
Graph 1: Age



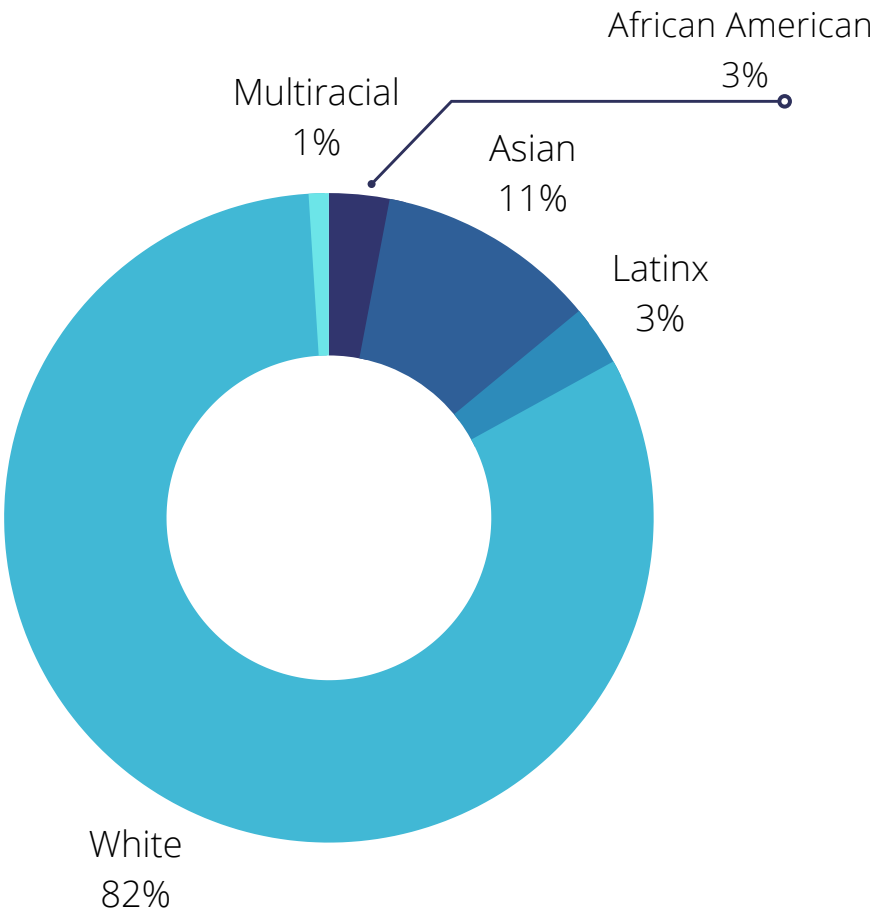
unvisualized: 1% of surveyed population is 70+

4. With respect to education level (degree obtained), we chose to categorize individuals by highest degree obtained, most notably when multiple graduate degrees were held. We categorized Law Degrees higher than Master's Level (i.e. if an individual held both an MBA and JD, we categorized them as JD. The same went for PhD versus JD, with PhD as the higher categorization). Also worth noting that in our sample size, "Doctorate Level" includes PhD, Medical Degree, Doctor of Pharmacy (Pharm.D), and Doctor of Education (EdD).

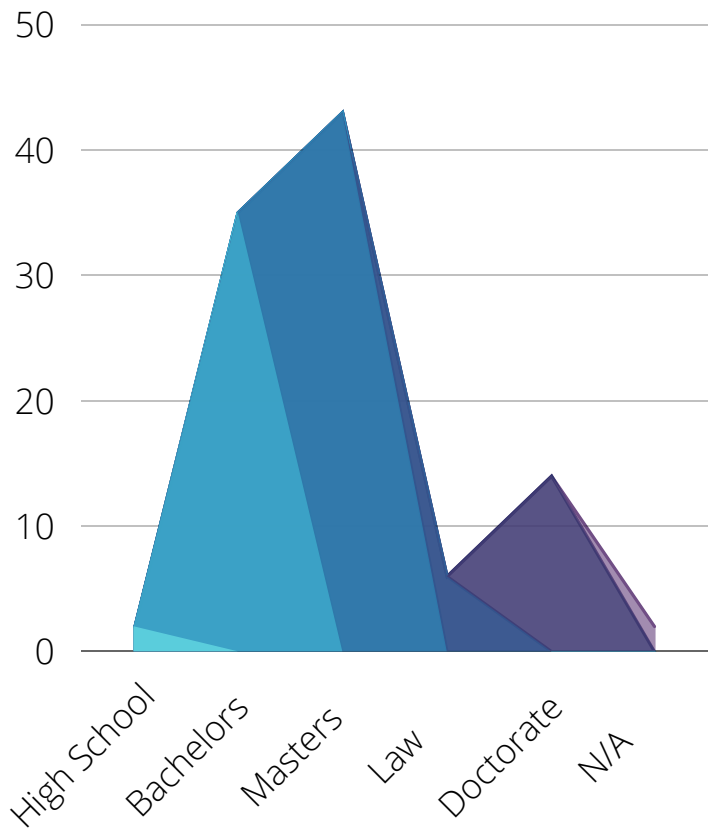
Graph 2: Gender Identification



Graph 3: Ethnicity



Graph 4: Degree



High School:	2%
Bachelors:	35%
Masters:	43%
Law:	6%
Doctorate:	14%
N/A:	2%

Participant Organizational Breakdown

PART interviewed or surveyed individuals from 176 unique organizations, and in instances of duplicate organizations (particularly in larger organizations) we attempted to engage multiple individuals in order to sample different roles or departments. Furthermore, multiple individuals "wear many hats" and represent more than one organization in the region, thus we categorized their "main" role or organization.

Below, PART provides the following definitions for how it categorized sectors in order to more clearly share the sectoral breakdown of our dataset:

Public Sector - Anyone working in a public agency; we focused on City of Pittsburgh, Allegheny County, and State of Pennsylvania

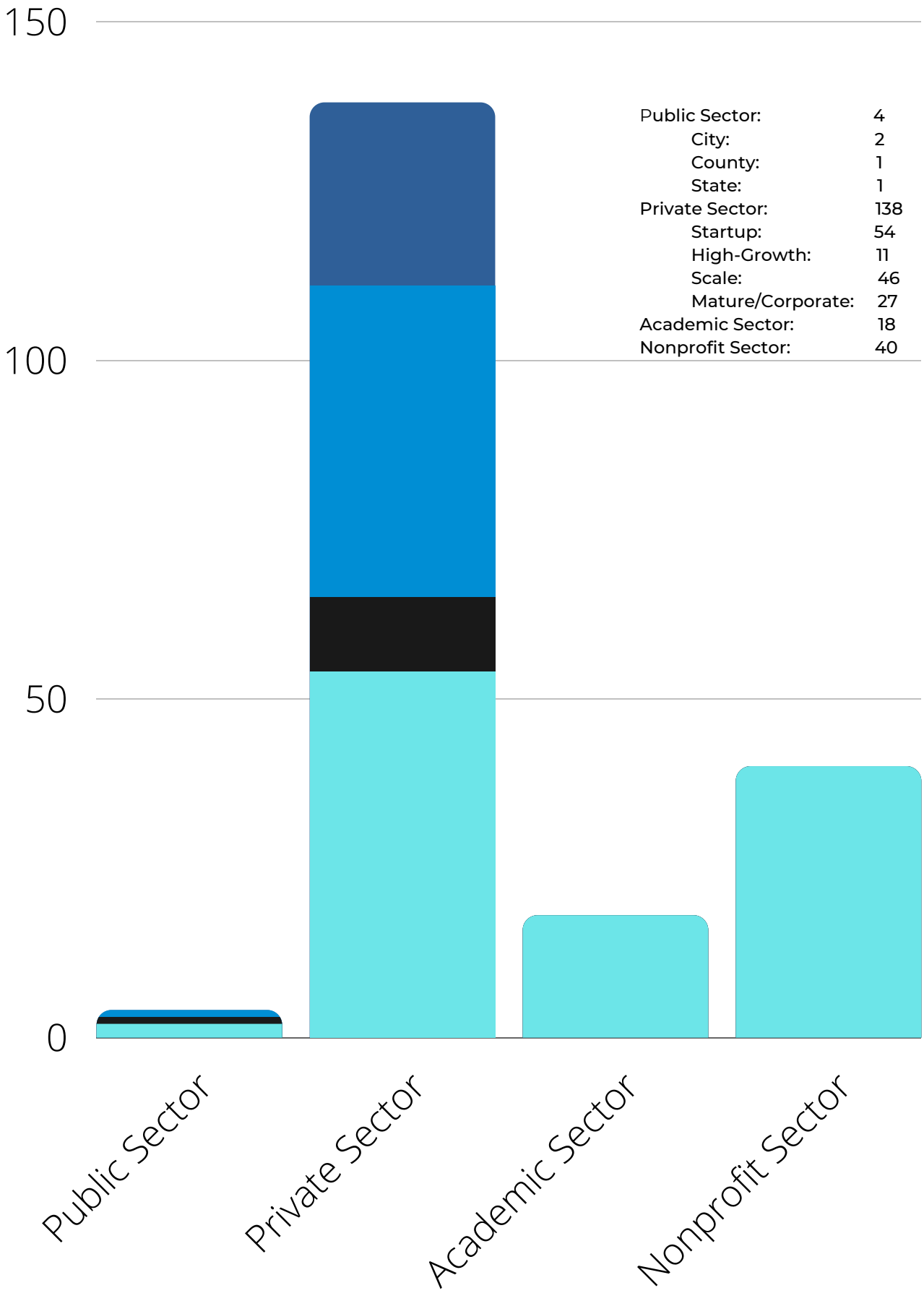
Private Sector - Anyone working in a for-profit company; we used a sub-sector breakdown to categorize businesses by size:

- Startup - Still in early stages of development; often still doing product development or initial client identification
- Growth - Product is market-ready and focus is on growing customers
- Scale - Rapidly hiring and taking product into new markets and regions
- Mature/Corporate - A publicly traded company or similar level with respect to annual revenue and resource operations

Academic Sector - Institutions of higher education, with participants working in either a teaching/researching faculty position, or administrative staff position (e.g. a Dean, or director of a student center).

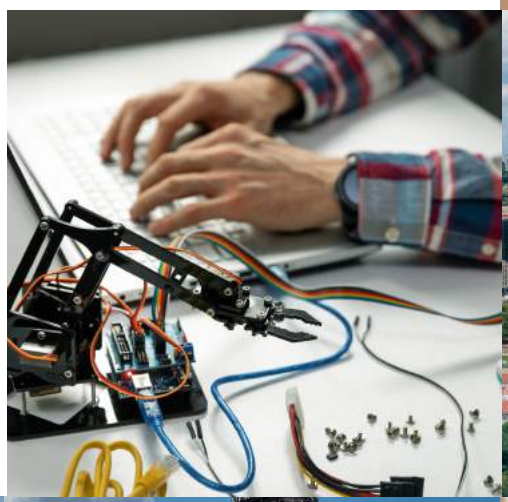
Nonprofit Sector - Not for profit, tax exempt organizations as defined by the Internal Revenue Service, such as 501c(3), 501c(6), etc.

Applying the above definitions, participants in our study were categorized in the following entity breakdown:



Similarly, study participants were further organized by industry or “field of work.” These fields were applicable across sectors, so for instance a study participant working in “Acceleration and Incubation” could be classified in either the Academic Sector, Nonprofit Sector, etc. Recognizing the possibility for endless subcategorization, for the purposes of this study we categorized participants in the following way:

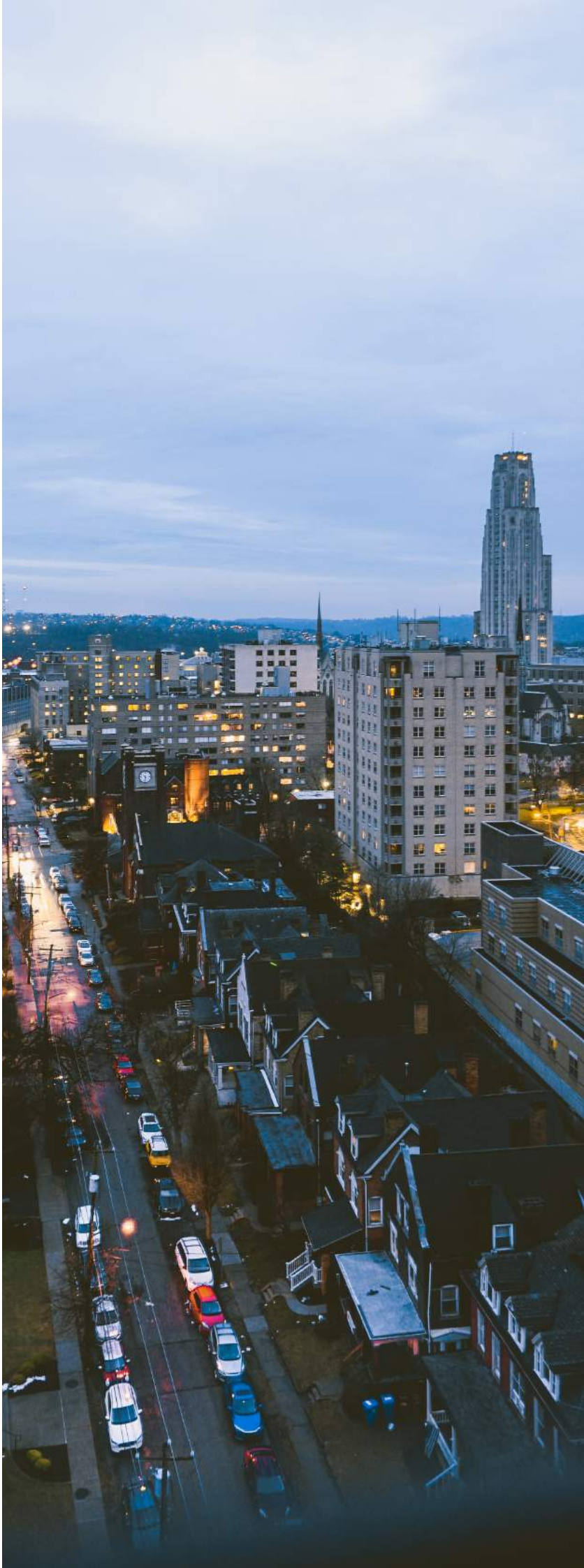
- Acceleration & Incubation - 11
- Agricultural Technology (AgTech) - 1
- Autonomous Systems - 4
- Cloud Computing and Services - 1
- Communications - 2
- Community & Economic Development - 10
- Consulting - 26
- Consumer Goods & Products - 10
- Consumer Services - 2
- Education - 13
- Finance - 3
- Healthcare - 10
- Infrastructure - 1
- IT Staffing - 1
- Law - 2
- Life Sciences - 3
- Media - 7
- Philanthropy - 4
- Public policy - 5
- Real Estate - 6
- Robotics - 15
- Software (incl. AI) - 50
- Technology Transfer - 1
- Tourism - 1
- Venture Capital - 11



Bias

Due to the limited nature of this (or any) study, PART of course recognizes biases in our dataset that are critical for the reader's awareness and understanding of the findings. Some of these biases are directly reflective of the demographics of the technology economy in our region. Throughout the report, we attempt to show relationships between identified themes and demographics to aid the reader in understanding that the problems discussed may be more severely felt by certain people.

Of note, this study is composed of a sample population that is predominantly male and white. This trend is definitely common in technology economies--one that many are seeking to change--and may relate to certain thematic prominence that we'll see below (e.g. which population sample is most concerned with Capital in our region). PART also found that the age mode was mostly individuals in their 30's or 40's; again a common industry trend, though not necessarily of our region where demographics trend toward an older population. Furthermore, our study participants happened to have higher levels of formal education, indicating bachelor's or higher, which may mean that our data is less representative of issues for those who seek to enter the tech economy. Lastly, our subjects mostly operated in the private sector, which was an intentional selection bias of wanting to give the highest awareness to those actively building companies, jobs, and innovations that make-up our local technology economy. However, we are aware many academic and non-profit actors are critical to our economy and may take a somewhat different view of things than those who are in the mindset of developing a business.



SECTION 2: ANALYSIS

General Remarks on Findings

Pittsburgh undoubtedly maintains the serious potential to be a dominant leader in many technology disciplines (like AI) yet our research findings indicate there are additional steps required to connect disparate activity--or introduce nonexistent assets--to truly capitalize on local innovations and create a hospitable milieu to efficiently build or operate a technology organization in the innovation and emerging-technology ecosystem.

Paradoxically, many study participants spoke of great assets in the region, such as colleges and universities (including extending beyond the University of Pittsburgh and Carnegie Mellon University systems), as well as mentioned thoughtful individuals working hard to attract attention to the region and play a part in expanding the innovation and emerging-technology economy in general. However, repeatedly across interviews and surveys, the PART team found individuals who were deeply concerned that they would not be staying in Pittsburgh (in essence, being driven away); that regional stakeholders and decision makers were not allocating human, financial, and other resources effectively to truly spur innovation and growth; and whether the economy's future would simultaneously find resolution to some of our region's most difficult problems and not miss capturing opportunities along the way.

Perhaps the most critical problem cited was Pittsburgh's ongoing and increasingly problematic human resource shifts. First, young, qualified, and diverse talent are not staying in--or coming in droves to--the region, even if they do pass through for a quick stint at one of the region's great education institutions. Second, leaders of many small to medium-sized private companies expressed a desire to eventually move operations out of the region (qualified in part by the historical difficulty of raising substantial financial investment locally). In troublesome parallel, there were multiple anecdotes of larger companies selecting other regions for headquarters or additional offices strictly for talent-related reasons, too. In these instances, the talent-related reasons were most often a lack of ability to ethnically diversify their workforce, including in leadership roles, as well as a finite talent pool in especially high-demanded fields such as artificial intelligence and machine learning (AI/ML), but also in areas like skilled sales.

The reasons behind these concerns can obviously be lengthy and varied, but in others situations, they are quite simple. Many large metro areas like Pittsburgh have traditionally under-invested in underrepresented communities, thus creating a scarce pool of affiliated talent ready to participate in the dynamic technology economy. What's more, Pittsburgh simply must do more to attract talent, starting with keeping recent graduates. Indeed, PART learned that some higher education institutions actually do so well in providing opportunities for students on campus, that students often don't feel the need to connect deeper with the city for personal, educational, or professional reasons, and as such find it easier to uproot after completing their program. Flatly stated, the "affordable", "most livable", and "food destination" labels only go so far in market messaging, and they aren't superseding other arguably more important topics like capital and client barriers, cultural homogeneity, and a leadership class widely-deemed to be "out-of-touch" with pressing needs. These areas will be explored more in depth later in the report.

Another common thread that PART observed—which linked together many themes, including the aforementioned demographic challenges—is that Pittsburgh's technology economy is not the healthy and exciting environment it wants to be. Most overarching, study participants in many ways directly conveyed (and served as proxies for other partners and colleagues) a mix of curiosity and bewilderment as to why the region had such a lack of targeted focus or real ecosystem-wide strategies for growth. Amongst younger citizens, the general feeling was a low ceiling for the region, not necessarily from a personal perspective, but regionally as many current leaders set an agenda that forecasts little excitement or change. Higher-level individuals we spoke with that have yet to be lured away by grander salaries in other markets noted several ways that cross-sector collaboration was minimal at best (such as the simple task of regional marketing). At times, of course, market competition, politics, history, or individual personalities can drive this, but with respect to Pittsburgh, a general sense of both an unavailable platform and imbalance incentive structures were prevalent.

Next, capital is scarce relative to other similar metros, and generally perceived as cautious (acknowledged without complaint by the sub-sector itself). Moreover, it was broadly accepted that there are just not enough strong incubator and accelerator programs to help get ideas off the ground in the region, thus entrepreneurially-minded people find themselves either discouraged or forced into conversation with investors and programs in other cities. This is interestingly rooted in both quantity and quality, the latter being explained as a lack of thematic incubators and accelerators; oxymoronically the "general" programs still being too "narrow"; and commitment levels, such as terms sheets or help beyond graduation being too restrictive or weak, respectively, for future growth. In the end the demand and supply of the Pittsburgh market appears imbalanced (for the good!) and opportunities in local tech transfer and entrepreneurship are missed because there are too few programs that help find seed funds and mentorship.

It's worth addressing one additional piece of the Pittsburgh story here--its unique history as it pertains to industrial evolution and economic development. Given the incredible assets available in local private philanthropy, there has been a history of companies, government, and individual investors looking to our philanthropic community for direction in where to invest. Many of the individuals in our research pool discussed the investments of private philanthropy as indicators of what will be up and coming in the near future, for better or worse. There is a perceived relationship between the decisions of the philanthropic community and seemingly separate choices made by our private sector, corporate investors, and accelerator programs. In reality, it's important to note that where the philanthropic community often invests it is because others (and perhaps better suited) organizations simply have not. What we know is that with targeted investments using collaborative data, activated regional and domestic partnerships, and a renewed focus on determining and communicating strategies that support an innovation economy, it is possible to generate fresh energy and make Pittsburgh more competitive.

With this optimism toward what the future can be, the themes of change that will be discussed through the remainder of this report:

CAPITAL:	Pittsburgh must cultivate capital channels appropriate for an innovation economy and better manage funds in the ecosystem
LEADERSHIP:	Pittsburgh must create intentional and inclusive cross-generational and cross-cultural leadership development programs
EDUCATION & TALENT:	Pittsburgh must invest in broad technology education and expand workforce development programming
REGIONAL & NATIONAL STRATEGY:	Pittsburgh must design a well-communicated regional and national technology economy strategy
METRICS & DATA:	Pittsburgh must maintain leading organizations with transparent metrics and are strong with data sharing and archiving

Analytic Approach

This report's themes were ultimately selected following multiple analytic phases of our data set. PART's team was initially broken up into two groups: field researchers and analysts. After developing the study protocol, the field researchers initiated participant interviews. After approximately 30 interviews, the field research team regathered with the analysts to independently review the first tranche of data and assess early-emerging themes. We created a set of codes and sub-codes to begin clustering topics and paraphrased sentiments from the first interviews. For instance, if one person described that the region lacks growth-stage capital, while another participant indicated they were forced to go to a different city to get their initial seed investment, we would code both of those as "capital" concerns (though never losing sight of the micro-differences of these capital investment comments).

For the remainder of the interview process, the PART team continued loading interview transcriptions into a new functional database, codifying all incoming information summarized below:

Strengths

People
Community
Talent
Institutions

Pain Points

Talent
Collaboration
Capital
Data
Structural Issues
Leadership

Opportunities

Key Ingredient
City-level
Companies
Partnerships
Convenings
On-radar assets
Under-radar assets

During the second wave of interviews, the wide-ranging discussions began to yield various topics or sentiments that did not fit a specific concept group. Surprisingly, it was during this second wave where issues such as “Diversity, Equity, and Inclusion” and “Public and Private Sector Leadership” started to emerge as major areas for us to pay attention to. To that end, we created new codes along those lines, and a miscellaneous category that purposefully captured the value PART added to the creation of a regional “safe space” as described earlier, which we characterized as “Questions PART should be asking.”

At the midway point of our research in December 2020, the PART team again reviewed all gathered data to shape and deploy our survey protocol. We used what we were learning from interviews to focus on certain areas and offer opportunities for people to compare the importance of different issues being raised frequently.

Upon deploying the survey and capturing the responses in the PART database, and simultaneously completing the interview portion of the project, we curated our data set into several tables which included participant information for each entry, organizational information for each entry, unstructured data (i.e. responses without coding), and structured data (all responses broken up into our coding schema).

Each PART team member independently reviewed the database to ensure no miscoding, and we separately flagged coding we disagreed on and then reconciled these choices in group research meetings. In the end, PART chose to dive into the themes that were a) the most common, b) affecting the most diverse set of stakeholders, c) most relevant to solution development, and d) had the opportunity to make the biggest impact if addressed properly.

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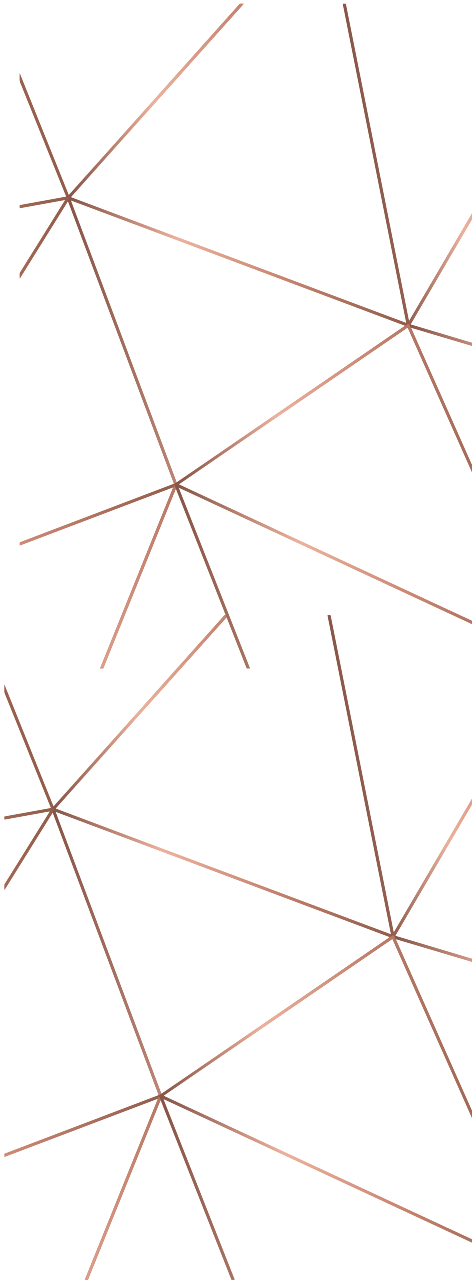
SECTION 3:
THEMES FOR REGIONAL FOCUS

PART suggests five macro-level themes that the Pittsburgh region's innovation and emerging-technology ecosystem should focus on to improve connectivity and build density, and as a result, put itself in a better position to internally capture various levels and locations of innovation and technology activity, ultimately in an effort to usher our economy to greater and responsible heights. In no particular order, and each further detailed herein, they are: Capital, Leadership, Education and Talent, Strategy, and Data.

Indeed, a few of these categories are not "newly discovered" issues, nor are they strictly or unanimously unique to Pittsburgh. Yet what needs to be stressed is the fact that first, due to Pittsburgh's size and structure, fissures across any of these issues are more intensely felt by a stakeholder group, a fact repeatedly emphasized by various public officials PART engaged for this process. Second, opportunity cost for Pittsburgh. As opposed to say Nashville or Miami, if Pittsburgh does not have an ecosystem wide-strategy to leverage and capitalize on our potential, it will be off-putting to operators and damage our reputation, which has only recently been able to slightly recover after years of decline following the steel industry changes. Third, failure to grow the economy, most notably with innovation and technology as the encapsulating umbrella, will have greater indirect effects on the future of our region. Apart from a dearth of high-scale growth companies emerging from our region, or new businesses making significant investments in the surrounding counties, other civic issues such as continued population decline, a decrease in the tax base, education quality, housing policies, attractiveness for domestic or international conferences, airport popularity, and infrastructure investments, just to name a few, will all suffer in coordinated fashion.

The subsequent tables below summarize how each theme was distributed across the various organizational and demographic categories of those who participated in our research:



Graph 1: Sector

Sample Size	Capital	Leadership	Talent	Strategy	Data
Academic (18)	10 (56%)	12 (67%)	8 (44%)	11 (61%)	3 (17%)
Nonprofit (40)	17 (43%)	20 (50%)	20 (50%)	33 (83%)	14 (35%)
Private - Startup (54)	41 (76%)	30 (56%)	31 (57%)	36 (67%)	4 (7%)
Private - Scale (46)	29 (63%)	22 (48%)	22 (48%)	30 (65%)	10 (22%)
Private - High Growth (11)	5 (45%)	2 (18%)	9 (82%)	8 (73%)	0 (0%)
Private - Mature / Corporate (27)	16 (59%)	8 (30%)	13 (48%)	22 (81%)	5 (19%)
Public -City (2)	2 (100%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)
Public - County (1)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	0 (0%)
Public - State (1)	1 (100%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Totals (200)	122	96	105	143	37

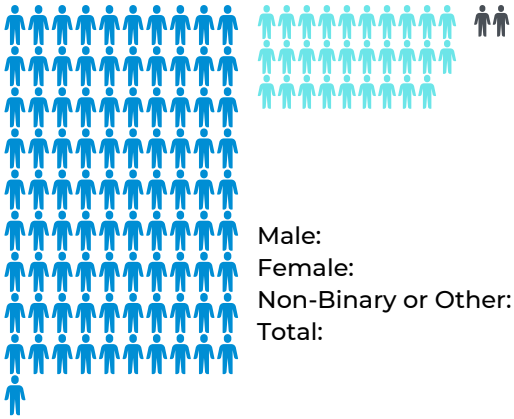
Graph 2: Ethnicity

Sample Size	Capital	Leadership	Talent	Strategy	Data
White (164)	98 (60%)	77 (47%)	92 (56%)	119 (73%)	28 (17%)
Asian (22)	17 (77%)	11 (50%)	11 (50%)	13 (59%)	6 (27%)
Latinx (6)	2 (33%)	2 (33%)	0 (0%)	4 (67%)	2 (33%)
African American (6)	3 (50%)	5 (83%)	1 (17%)	5 (83%)	1 (17%)
Multiracial (2)	2 (100%)	1 (50%)	1 (50%)	2 (100%)	0 (0%)
Totals (200)	122	96	105	143	37

Graph 3: Gender Identification

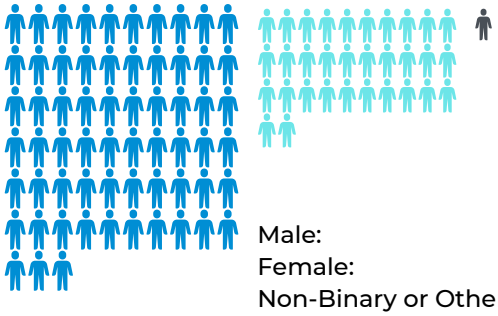
Sample Size:	
Male	135
Female	62
Nonbinary or other	3
Totals	200

CAPITAL:



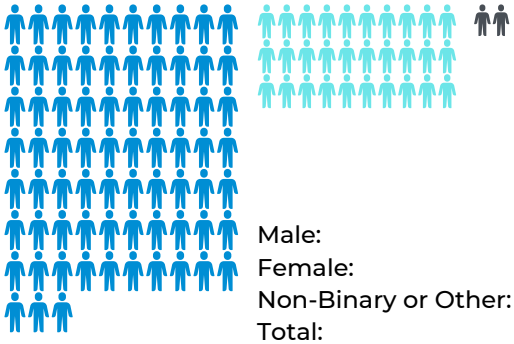
Male:	91 (67%)
Female:	29 (47%)
Non-Binary or Other:	2 (67%)
Total:	122

LEADERSHIP:



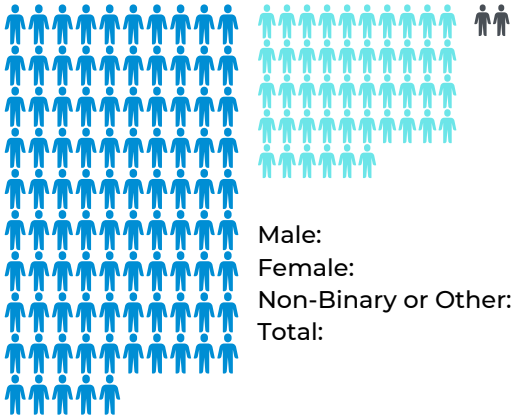
Male:	63 (47%)
Female:	32 (52%)
Non-Binary or Other:	1 (33%)
Total:	96

TALENT:



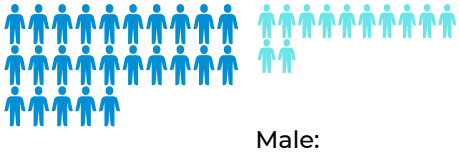
Male:	73 (54%)
Female:	30 (48%)
Non-Binary or Other:	2 (67%)
Total:	105

STRATEGY:



Male:	95 (70%)
Female:	46 (74%)
Non-Binary or Other:	2 (67%)
Total:	143

DATA:



Male:	25 (19%)
Female:	12 (19%)
Non-Binary or Other:	0 (0%)
Total:	37

Graph 4: Age

Sample Size	Capital	Leadership	Talent	Strategy	Data
20-29 (23)	15 (65%)	9 (39%)	15 (65%)	15 (65%)	4 (17%)
30-39 (67)	38 (57%)	29 (43%)	37 (55%)	52 (78%)	10 (15%)
40-49 (52)	32 (62%)	27 (52%)	24 (46%)	37 (71%)	11 (21%)
50-59 (28)	17 (61%)	16 (57%)	10 (36%)	21 (75%)	6 (21%)
60-69 (11)	9 (82%)	8 (73%)	6 (55%)	6 (55%)	2 (18%)
70+ (1)	0 (0%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)
N/A (18)	11 (61%)	6 (33%)	13 (72%)	11 (61%)	4 (22%)
Totals (200)	122	96	105	143	37

Graph 5: Degree

Sample Size	Capital	Leadership	Talent	Strategy	Data
High School (4)	2 (50%)	2 (50%)	4 (100%)	3 (75%)	1 (25%)
Bachelors (70)	44 (63%)	37 (53%)	37 (53%)	49 (70%)	12 (17%)
Masters Level (85)	48 (56%)	38 (45%)	45 (53%)	60 (71%)	19 (22%)
Law Degree (11)	8 (73%)	5 (45%)	4 (36%)	10 (91%)	0 (0%)
Doctorate Level (27)	17 (63%)	12 (44%)	14 (52%)	19 (70%)	4 (15%)
N/A (3)	3 (100%)	2 (67%)	1 (33%)	2 (67%)	1 (33%)
Totals (200)	122	96	105	143	37

THEME 1: CAPITAL CHANNELS FOR AN INNOVATION ECONOMY

Pittsburgh must cultivate capital channels appropriate for an innovation economy and better manage funds in the ecosystem

Overview

What could be viewed as a platitude at times when a study indicates an economy has "money problems", the types of problems, and ways a city activates channels for the accumulation and deployment of capital to solve those problems, draws the contours of any innovation or emerging-technology economy.

Investing in potential game-changing ideas and companies requires investors (and their partners) who are willing to simultaneously be risky, be patient, and be educated on the long-term trends and adoption related to future products, services, or platforms.

What's more, to complement the traditional profit motive of the venture capital and private equity class, it's extremely important for various types of capital managers to have a wider and clear understanding of any region's economic development strategies to ensure financial force multipliers wherever possible. Beyond identifying the right ideas and individual teams, high-growth technology companies often are highly vested prior to revenue growth due to the need to scale their platform or user base as a key to unlocking their value (5).

5. Platform technologies such as Facebook, Snapchat, or Instagram, all had to grow large user bases prior to discovering key revenue sources or finding the right exit partner. A local company that has a trajectory like this is Niche.com which grew out of College Prowler and built a large user base and clean online product prior to maturing its sales patterns and revenue streams (e.g., selling leads to charter schools and universities)

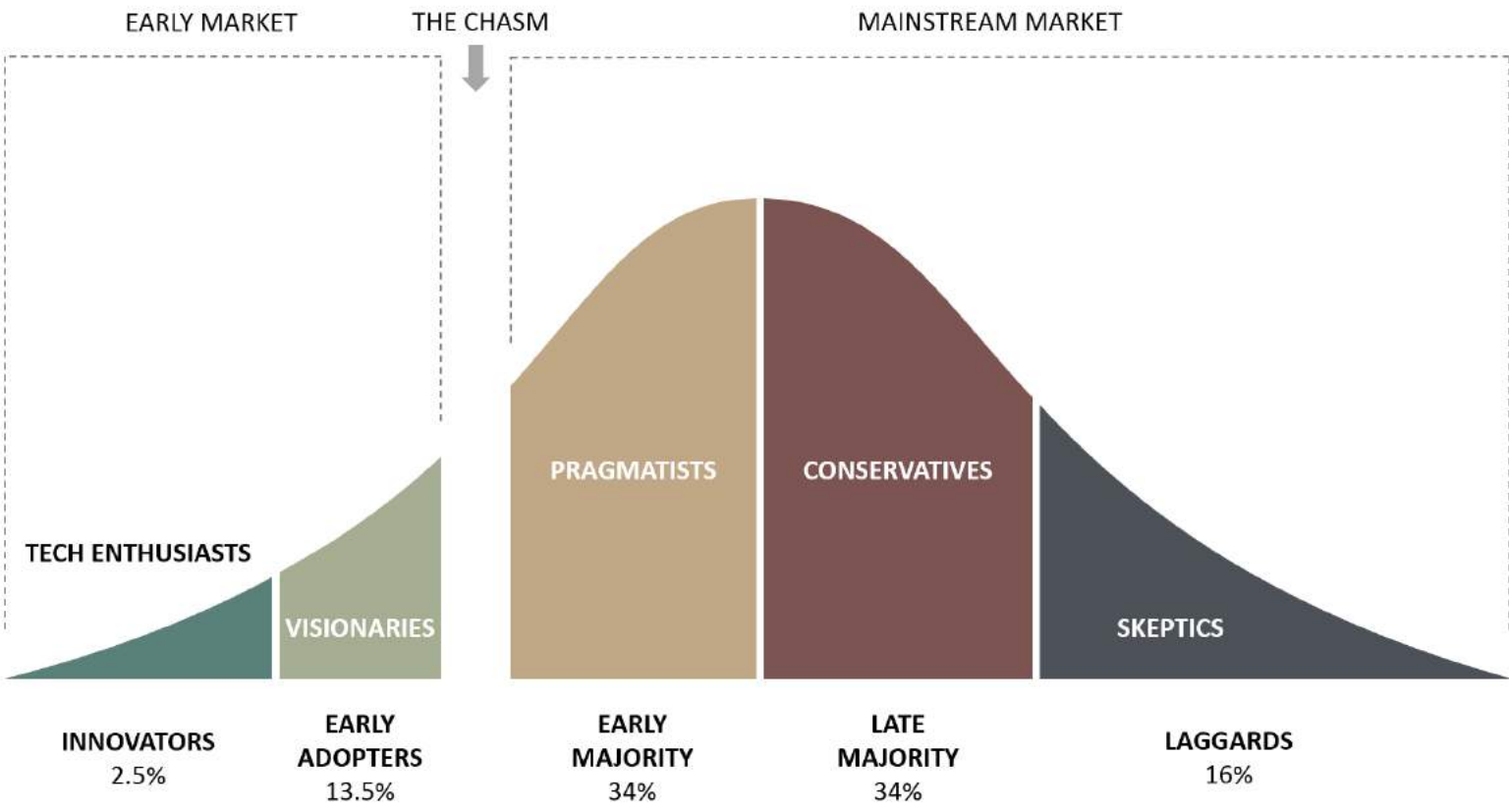


Figure 1: Technology Adoption Curve and Growth "Chasm" (6)

To be a company that benefits from the scaling adoption of a new technology requires a comprehension of the adoption life cycle and potential capitalization of a product bridging the early and mainstream markets. Successful innovation economies need to attract and cultivate individual and institutional investors with similar celebrated vision and brave risk tolerance to clear the "chasm" of adoption that forms while customers and markets adapt to change and disruption.

This notion causes great pain in Pittsburgh, unfortunately. Capital needs certainly aren't unique to Pittsburgh when looking across domestic metro areas, nor is it particularly a "new" problem here. But there are reasons why tech entrepreneurs--many of whom have experience operating in other markets--relayed to PART the biggest barrier holding Pittsburgh's technology economy back is "financing after MVP for scaling up." (7) What's more, "funding here past the initial stage is a major barrier, especially if the tech company is founded by anyone of color"; and "getting funding beyond the first $50K (which actually is quite easy) takes a lot more than just a good idea in Pittsburgh."

6. Image from: Moore, G.A. (2014). Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers. Harper Business.
7. The common acronym for "minimum viable product", a status for a good or service where it is developed just enough for early customer use, but flexible enough to incorporate feedback or adjust to fix errors.

In this section, PART aims to go beyond documenting instances like the above where limited funding created frustration. For Pittsburgh specifically, where in the capital markets can new or different initiatives create the most impact? Put another way by a leading official at a local business accelerator and incubator "1 in 100 companies actually progress meaningfully behind angel and seed rounds here. Sure, Pittsburgh obviously needs later stage capital, but actually it really needs more angles to get companies going."

> 1 in 100 companies actually progress meaningfully behind angel and seed rounds here. Sure, Pittsburgh obviously needs later stage capital, but actually it really needs more angles to get companies going.

Diversification

Across PART's interviews and surveys, a chorus of voices articulated the need for more--and diversified--types of investment capital in Pittsburgh's ecosystem. Of the 200 unique individuals interviewed or surveyed, more than 120 brought up issues regarding capital access and management in our ecosystem. There were consistent concerns that we do not have enough seed resources, or routes, for early funding, and an even larger set of folks pointed to the scarcity of growth-phase funds for scaling up operations.

These endorsements align with similar signals in the Innovation Works (IW) 2020 "Investment in Pittsburgh's Technology Sector" report covering 2010-2019. Two key points made: 1) IW directly points out that there has been a reduction in the supply of local capital; and 2) the number of unique organizations funded each year is stagnating in the low-to-mid 100s. One would expect the number of unique companies to be growing linearly as some previously funded organizations continue to garner funds while new companies continue to enter, a movement quite necessary to accelerate an innovation economy. Either Pittsburgh companies are dying or leaving too quickly, or new entrants are struggling to get investment causing a compounding annual stagnation.

Additionally, alignment with these expressed pains is evident from the 2017 Brookings Report, "Capturing the next economy: Pittsburgh's rise as a global innovation city." The report made mention that Pittsburgh has too high a ratio of R&D dollars to the number of new firms and tech jobs being created. Brookings also pointed out that Pittsburgh is below the national average for high-growth firms and that we have insufficient pre-seed and start-up activities to activate the needs of the research entrepreneurs. Critically, they found our tech sector is not producing jobs at a fast-enough rate to replace the jobs that are slowly becoming automated and outsourced. Combining these facts with the troubling reality that young talent is not staying in Pittsburgh as described earlier causes PART to recommend a re-examination as to whether we have built the right capital channels to make sure young and middle-aged talent are given the opportunity to obtain the necessary resources to create companies and more importantly, jobs, here in the city. (8)

8. During the course of this research project, several new capital vehicles were created, including the 412 Venture Fund, Black Tech Nation Ventures, Magarac Venture Partners, and The Fund launching its Midwest region to include Pittsburgh. Undoubtedly, these announcements must be applauded, yet the scale must be highlighted. 412 Venture Fund's public goal is $20M for "early stage" companies; Black Tech Nation Ventures's public goal is $50M for "marginalized groups" running tech companies with at least a seven-figure valuation; Magarac Venture Partners, with ¾ of its partners from Draper Triangle Ventures, has a public goal of $100M-$150M for Seed and Series A rounds; and The Fund Midwest's public goal is $2.5-$3M for "early stage" including women and minority-owned entities. Combined, approximately $200M is certainly great for Pittsburgh, it would be barely average in other metros with less technology economy potential, including for instance, Columbus. There is still much development to do to ensure that Pittsburgh innovators get funded in Pittsburgh, stay in Pittsburgh, and grow in Pittsburgh, and that the city operationalizes enough ideas to replace jobs that are continuing to be outsourced and automated.

Culture Shift

Some interviewees (including those seeking capital, those who have successfully raised local capital, and even those responsible for deploying capital) referenced a widely-held belief that Pittsburgh is “cheap” so companies don’t need much cash to get going. In actuality downstream, this belief system and modus operandi rapidly stalls growth potential by placing companies in “preservation mode” with cash in their early years. A corresponding sentiment from a local successful start-up CEO is that the Pittsburgh technology start-up scene is unfortunately full of “zombies”, popularly recognized national parlance describing a business stage the publication Inc. notes as “neither dogs nor stars.” (9) Put in other words by a highly-successful and widely-respected member of a local University, Pittsburgh practices “egalitarian starving”, referring to companies getting small drips of funding without ever receiving the critical capital (and associated feedback) needed to lock in talent and scale operations.

Obviously PART recognizes that within the venture capital industry, spreading investment makes sense as the statistical likelihood of finding that “unicorn” or “home run” is extraordinarily low; but, and as we’ll discuss later in Theme 4 pertaining to Strategy, the notion of capital is a microcosm of the larger Pittsburgh economy in that operators tend to skim the surface too much (whether for risk tolerance or risk of offending someone) and deeper investment in a few quality areas would have more impact.

Further qualifying this evidence that our capital channels may not be tuned-in to a modern innovation or emerging-technology economy, many of our interviewees discuss idiosyncratic problems with our start-up investment scene. For example, several stated that the investment terms of the region’s early funding programs are not industry aligned and detract follow-on money from other tech investors. Others stated that local economic development funds from a variety of cross-sector sources are not always being deployed in ways that aid in the growth of the technology or tech-adjacent sectors, which many believe are still fixated on older, more traditional, and less technical industries.

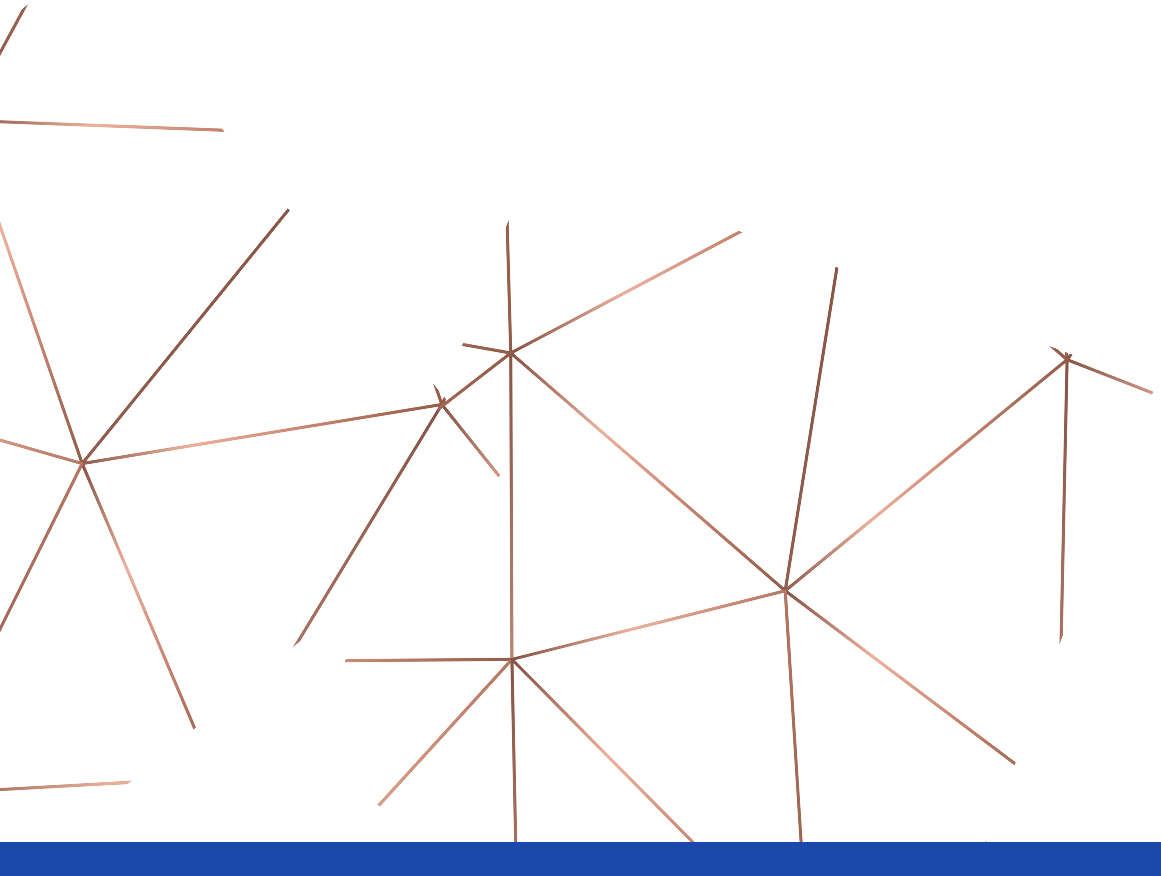
PART also documented several instances from study participants of start-ups that were completely overlooked by Pittsburgh investors and accelerator programs, yet have found successful footing in other cities where the capital channels were more abundant and better understood the path to innovation economy investing. Across PART’s robust data, the phrases “risk capital,” “patient capital,” and “diversified funding” come up again and again as insufficient and deleterious.

9. Inc.com. “8 Signs Your Startup Is a Zombie, and 3 Things to Do About It: Knowing when to quit and when to stick with it is a key skill for all startup founders.” 2018. https://www.inc.com/sean-wise/8-signs-your-startup-is-a-zombie-3-things-to-do-about-it.html

Post-Mortem

On the other hand, there are a few in the local ecosystem who disagree with these capital complaints. A minority of our interviewees and respondents stated that quality companies attract capital, and that capital is accessible once you've had a few successes and know the right people. Though these considerations are essentially truisms of business, they raise interesting questions about how we're determining what makes a company appear "strong" and what we should anticipate a likely successful entrepreneur looks like in terms of past experience. More importantly, are these truisms enough to make Pittsburgh ready to be relevant in the national and international race to compete in the major economic transitions that will occur in the coming few decades?

One shining light of opportunity is that IW's 2020 report claimed that there has been a number of successful exits in our ecosystem: 103 companies with $10.7 billion in total value over the decade of 2010-2019. It's PART's sincere hope that there are already conversations with the individuals that took home some of that capital to both capture and share lessons learned for other entrepreneurs, as well as ensure that portions of the wealth generated by exits is redeployed in circular fashion into the local ecosystem to develop and finance the next generation of successes--a popular practice in many other markets proven to increase economic activity. Ensuring that these people are engaged and remain active in the Pittsburgh region will be a key part of revisioning the local capital environment and management thought-processes.



Evidence, Interpretation, and Recommendations

Of the 122/200 that brought up capital:

- 10 “Academic”
- 17 “Nonprofit”
- 41 “Private Startup”
- 29 “Private Scale”
- 5 “Private High-Growth”
- 16 “Private Mature/Corporate”
- 2 “Public Sector” city
- 1 “Public Sector“ county
- 1 “Public Sector” state

Of the 122/200 that brought up capital:

- 15 aged 20-29
- 38 aged 30-39
- 32 aged 40-49
- 17 aged 50-59
- 9 aged 60-69
- 0 aged 70+
- 11 age N/A

Of the 122/200 that brought up capital:

- 29 Female
- 91 Male
- 2 Nonbinary or Other

Of the 122/200 that brought up capital:

- 3 African American
- 17 Asian
- 2 Latinx
- 2 Multiracial
- 98 White

Of the 122/200 that brought up capital:

- 2 High school
- 44 Bachelors
- 48 Masters Level
- 8 JD
- 17 Doctorate Level
- 3 N/A

Beyond the recorded evidence--which includes anecdotal examples--in this section, and in each subsequent thematic section, PART also offers particular interpretations of what these conversations (in this instance, regarding capital) means for Pittsburgh going forward and how to alter negative perceptions or operations.

Over 60% of our study participants specifically called out that capital access is an issue for them and for the region. Notably several dozen were minorities, but nearly 100 identified themselves as “white” (obviously a relative power to the overall demographics of study participants) and several dozen more had advanced education.

Our region’s investment portfolio mix is not particularly attuned to funding vehicles that will propel innovation and emerging technologies like AI far in either efficacy or coordinated fashion.

As a product of this first macro theme, and in order for the Pittsburgh region to begin building and diversifying capital channels for an innovation economy--as well as successfully investing and measuring returns such that technology innovation investments are successful in growth--PART highlights below several recommendations that individuals, institutions, and important nodes within our innovation and emerging-technology ecosystem should consider tackling. In a few words, our region’s investment portfolio mix is not particularly attuned to funding vehicles that will propel innovation and emerging technologies like AI far in either efficacy or coordinated fashion. Some recommendations to change this include:

Recommendation 1:

Increasing both the number and varying type of start-up accelerator programs, incubation environments, and entrepreneurial opportunities that provide capital and have articulated connectivity to investors. For instance, a thematic accelerator and incubation program dedicated strictly to artificial intelligence or robotics, that also helps bridge the gap to the next round of funding.

To be a leader in launching, growing, and even retaining technology companies, the supply-demand equilibrium within the accelerator-incubator network must become better balanced. Two repeated views we found common were that Pittsburgh simply needs more accelerators as Pittsburgh-born start-ups are often being poached by other cities' accelerators, and that the accelerators we do have need to adjust to terms and investment structures that are more aligned to tech industry standards. There are obviously many reasons why a company could be denied entry into a program, but Pittsburgh loses out when "capacity" is the main reason. A local entrepreneurship expert stated "places like Innovation Works and Ascender simply can't keep up with local supply. Buffer that against CMU and the University of Pittsburgh getting contacted every week by out-of-town accelerators, and it's clear we need massive help here if we are going to grow."

Recommendation 2:

Establishing relationships with successful technologists and entrepreneurs in the region to convert them into investors, mentors, and advisors.

A local tech CEO noted to PART the regretful reality that "there is not the individual-level venture capital mindset [in Pittsburgh] as there is on the West Coast, which has certainly held back our growth potential."

Quantitatively, PART makes it clear elsewhere in this report that more capital--and diverse capital--is needed throughout the region. But from a quality standpoint, a new "capital mindset" is required, too. We found that the notion of a circular economy isn't very strong in our region (i.e. investing back into the local economy once a company is acquired or receives a large injection of capital) and furthermore, more education is needed here to help attract the proper mix of capital from inside and outside the region. For example, PART learned of an instance where several venture capitalists were interested in creating bigger funds than what traditionally existed in Pittsburgh prior, but left the region due to such a small network of investors locally who deeply understood technology progress was scarce. In another example, the owner of a Pittsburgh-based company which was recently acquired in the last few years specifically related "I'll never reinvest in Pittsburgh" due to the lack of a collective strategy for helping entities in the region grow and utilize force multipliers.

Recommendation 3:

Learning to better identify companies with high-growth potential earlier in the life cycle to focus on capital access and scaling resources.

It would be unfair to make this general recommendation without calling out some of the tremendous success of the region's accelerators, incubators, and University programs that have and will continue to provide identification, recruitment, and education. The region is lucky to have them.

But based on PART's research, this identification can both be more robust, and the public, private, and academic community can do a better job not routinely deferring to the philanthropic foundations to also do this while trying to executive their charitable missions.

As a CEO from a leading media platform noted to PART "philanthropic foundations are many times the venture capitalists of sorts in our region" going on to say this practice is "unfair to the foundations" and tends to let other players in the region "off the hook."

Recommendation 4:

Developing a formal and collaborative strategy for bringing new regional and national investors into our local capital pool.

PART documented a flurry of quibbles around the lack of growth phase capital, poorly deployed seed capital, and capital that was not risk tolerant enough for truly building the next innovation economy right for Pittsburgh. Of course there are several cases where "if we were based in Silicon Valley, we'd be funded yesterday", but PART recognizes that doesn't always indicate a quality company, nor a fair comment on the "level of fit" for that specific company in Pittsburgh. Simply put, however, access to capital at rates that encourage large scale growth in Pittsburgh is falling short.

A local attorney, whose portfolio is a healthy mix of local, domestic, and international tech companies, described that "both companies and investors in the Pittsburgh market need to get more comfortable with term sheets that are quite common elsewhere, and actually get capital into companies and our local market without a prolonged struggle. Tangibly, investments like SAFEs (simple agreement for future equity) or convertible debt which are both company-friendly have been hard to push in Pittsburgh, which ultimately can hold back potential."

Recommendation 5:

Offering more opportunities for local investors (or potential investors) to meet and see local talent and ideas; intentionally intermingling funders with early/mid-career talent and great ideas.

A common trope is that it is easy to do business in Pittsburgh; that meeting people here and getting introductions is simple if one just asks. While that appears to be certainly true for some, and there is undeniably also a certain Pittsburgh-ness about doing business here, it isn't as common or as easy as suggested at surface level.

PART recommends better programming across sectors to intentionally intermingle investors with talent and ideas. There are widespread networking events, pitch competitions, and other programs meant to bring together diverse individuals, but deeper, more targeted interaction would go a long way.

A tech entrepreneur, who has been quite successful in obtaining capital and navigating the regional ecosystem with multiple entities astutely opined "Pittsburgh is following benchmarks to the old patterns so we can feel good about what we are doing relative to our neighboring ecosystems. To be fair, maybe this does represent the best that could be done here. But we are certainly setting our goals too low, and are getting caught up in playing the game designed for a different ecosystem - we can be bigger."

Recommendation 6:

Translating information about emerging technologies, high-growth industries, and transitioning sectors to local individual and organizational investors and the business community via a common infrastructure with simple and digestible formats.

Quite interestingly to PART, four separate individuals--a city official, a technology transfer professional, a University-based entrepreneurship educator, and a member of a regional economic development authority--all referenced Cincinnati, Ohio as a city which has excelled at communicating ecosystem needs to the private sector, and getting companies off the proverbial sidelines and involved in the local innovation and start-up tech community as either investors or first customers. Two of those people pointed to organizations specifically built to connect corporations with tech startups for first customer programs, like StartupCincy. Two others directly cited how a single corporate benefactor--in this instance, Procter & Gamble--as being responsible for building community and taking action to create an innovation ecosystem in the region, which also helps facilitate investments. "Cincinnati has one of the best models of private companies working together to pool funds and resources to seed growth in talent, diversification, infrastructure, recycled investment, and mindset" is how one interviewee put it, adding "In Pittsburgh, everything thinks everyone else is doing it." Procter & Gamble was also brought up as the sole driving force behind the popular Techstars program coming to Cincinnati. The aforementioned Pittsburgh city official went further saying the private sector is unaware how to tangibly and genuinely invest in and make contributions to "talent development before employment; research and development for the ecosystem; and collective policy making." For example, in Pittsburgh, a prominent roboticist asked "What happened to prevent a company, say FedEx, from doing in Pittsburgh what other corporations have done in places like Cincinnati?"

Recommendation 7:

Investing in supporting research, business, and tech-specific social communities that cross-pollinate the region's research and business talent, and aid in start-up generation (e.g., funded hack-a-thons, techie clubs, technology arts, and gaming meet-ups).

"Imagine how far the technology economy could propel this region into the future if Pittsburgh invested half of the time and money (direct, and offered off-sets) as it did into trying to secure Amazon's H2Q. Sustainability alone of this investment pattern would pay dividends for decades."

An interesting prospect.

THEME 2: RAPIDLY ADAPTING LEADERSHIP

Pittsburgh must create intentional and inclusive cross-generational and cross-cultural leadership development programs

Overview

Who starts companies, who manages teams, who mentors young leaders, who builds partnerships, who identifies big ideas, who effectively fundraises, and who is successful at retaining and elevating talent hinges on who is in a position of leadership currently, and in parallel, governs how an innovation and emerging-technology ecosystem identifies, fosters, and ultimately transitions new leadership into the next generation?

The study of leadership is so complex and nuanced that an entire cottage industry of formal and professional education and mentorship has developed overtime. For its role, Pittsburgh has had remarkable success in producing leaders throughout time, requiring anyone to look no further than some of the innovative and influential public officials, titans of industry, medical rock stars, philanthropists, artists, and even athletes that have covered pages of domestic and international history books and immeasurable square feet of exhibitions.

However, solicit input from diverse and dynamic individuals or entities in our innovation and emerging-technology ecosystem, such as a highly visible repeat entrepreneur, and one might hear “leadership [here in Pittsburgh] is nonexistent. It’s worse than that, it’s worse than no leadership, it’s negative leadership.” Indeed, any objective and independent analysis needs to parse deep historical occurrences, fierce competition, and plain and simple personality differences from any declarations, but why do feelings like this pervade?

Echoing the 2017 Brookings Report, Pittsburgh remains threatened by changing demographics of talent. To develop competitive technology companies and foster innovation requires new and varied voices to present unique and challenging ideas that provocatively ask for us to think differently.

Despite knowing this, PART recorded numerous instances where Pittsburgh's workforce felt let down by multi-sector leadership. For instance, across study participants the female workforce and communities of color felt dismissed, and that entry (let alone advancement) is inaccessible to them. Regarding the African American population specifically, holding aside stated grievances as to lack of support in the business community, participants also referenced public arguments attesting to rising crime, blight, and gentrification as to why 7,000+ black residents have left the city since 2014. (10)

But leadership even came up even amongst white males, who continue to make up most of the leadership positions across the world. Holding the upstream logic aside, downstream it's without debate that a leadership movement towards robust inclusivity and building intentional pathways into our innovation and emerging-technology economy has great room for improvement.

There are, of course, dozens if not hundreds of local multi-sector leaders who are excelling at attempting to directly or indirectly chart a path of economic and social success for the Pittsburgh region. It's perfectly acceptable to say we must take advantage of these leaders and their ideas, ensure they remain in the region, and give them the tools they need to succeed; while in parallel, not be shy in noting that large swaths of local leadership are out-of-touch with the needs of a modern economy, dramatically need to diversify, and recognize the merits of outside opinions. As the legendary Italian soccer manager Giovanni Trapattoni was often quoted saying "a good manager can make a team 10% better, but a bad manager can make that same team 30% worse."

Inspiration

Primarily, leadership in general, especially in the Pittsburgh region, must be seen as intersectional with talent development, attraction, and retention. It's very clear that inspiring and inclusive leaders help keep talent within company walls and city borders, and in any successful region, thoughtful leaders will identify new talent and support the development of these individuals and organizations to grow the next generation. Relying on another well-known adage, often great talent does not walk away from a job or company, but rather a specific manager or leader.

Strong leadership will determine the success of the Pittsburgh innovation and emerging-technology economy. As most any layperson is well aware, fissures are forming in the connective tissue of our current and future economic structure due to the speed in both the quality and quantity of young talent with leadership qualities fleeing our region. Evidence from across PART's research--nearly 50%--expressed frustration that current leaders are practicing "hanging on" and "hanging out" rather than actively building inspirational pipelines to recognize new leadership potential, let alone help it grow.

10. Pennsylvania Capital-Star. "Some Black Pgh leaders disagree that Black people are only leaving the city by choice." 2021. https://www.penncapital-star.com/government-politics/some-black-pgh-leaders-disagree-that-black-people-are-only-leaving-city-by-choice/

Tactics

The distance between leadership and the broader talent pipeline is creating problems beyond just losing potential CEOs or innovators. Leadership challenges are likely connected to another finding of our research which is we are lacking Project/Product Managers and Senior Talent (e.g., COO's, Marketing, and Sales) needed to scale and mature promising companies. Extending further, young leaders find it difficult to identify and get time with advisors and mentors who have relevant experience to help them grow professionally and make needed connections. On the ground, people feel the landscape positions everyone competitively against each other; especially when it comes to getting in with Pittsburgh's current leaders and funders.

The leadership programs and forums available in our region are too narrow. Leadership Pittsburgh and Leadership Development Initiative are a fantastic resource to connect "new" faces to established networks; however, the program is prohibitively expensive, making it inaccessible to most people if they even know about it. Likewise, CORO and similar programs have brought a small pool of talented and dedicated people to the city each year, but it too suffers bandwidth issues, struggles to widely incentivize entities to partner, and has had difficulty in keeping people in the city after their fellowship year or offering competitive stipends as other programs in other regions.

Repeated discussion topics vis-a-vis leadership were: poor collaboration and support models; an inability to access quality mentors; and inadequate transparency coming from current leadership. Additionally, many participants were concerned that current leadership often dismissed ideas coming from outside of the region or from new voices. However truly valid, these few examples came from technology companies which knowledge and experience in other ecosystems such as Boston, San Francisco, and New York, and not only is Pittsburgh fractured internally in terms of connectivity, but doesn't capitalize on leadership offerings via delegations in and out of the region to support cross-pollination of ideas.

A comprehensive project to connect leadership and talent across cultures and generations in a collaborative context could be transformative for the region. Activating more channels for mentorship, intentionally investing in talented women and people of color, opening doors to inclusive networking that bridges new and old Pittsburgh, broadening talent pipelines to attract roles beyond coders, and making an explicit strategy for keeping young people engaged and enthusiastic about Pittsburgh are all pieces of a complex puzzle that could shift the tide of frustration and bring about a new generation of exciting leaders for the region and ecosystem.

Diversity

There is also a growing frustration around the lack of diverse leadership in Pittsburgh. As expected, this sentiment was most pronounced, but not exclusive to, the responses from people of color and women, both of whom are painfully underrepresented in our Public and Private leadership. PART learned directly that not only has this been a source of people leaving Pittsburgh under the assumption they will never hold a position of leadership, but it has also categorically kept companies--and people--from coming to Pittsburgh. In one dramatic instance, for example, Airbnb chose to invest in Atlanta over Pittsburgh for this very reason. Per Kyle Chintalapalli, Vice President of Business and Economic Development at the Pittsburgh Regional Alliance, Airbnb chose to open a new center in Atlanta "in large part because of their region's commitment to diversity. It is built in there. We have the opportunity to do the same thing in Pittsburgh."

To provide help and support around this theme, PART heard several wishes summed fundamentally up by three separate leaders: "There needs to be more female leadership in the region. It honestly felt like moving back in time when I moved to Pittsburgh because of less female employees in leadership roles." "For women, I honestly think it has gone backwards. It's gotten worse. If it doesn't come from a man, we have to be indifferent about whose idea it is." "So many ideas have--and will--continue die on the vine if we don't address Pittsburgh's lack of minorities in the technology economy."

These and countless other testimonials are merely scratching the surface of how many key players in the local economy directly observe how a lack of diversity in both leadership appearance and thought-leadership is holding back our innovation and emerging-technology economy, and how the real and perceived challenges for women and minorities to advance into positions of leadership are causing underemployment and talent to look elsewhere, including upon graduating from local colleges and universities. Another prominent local tech CEO referred to various individuals and legacy organizations as 'shadowy', meaning their tenure, presence, and ability to consume financial resources and attention casts such a long and dark shadow across the economy, that potentially brighter alternatives are snuffed out, thus perpetuating status quo at best, and reverse-innovation at worst.

Elsewhere in this report is discussion about the need to boost diverse backgrounds, not just from a demographic or ethnicity standpoint, but from a skillset perspective as well.

Evidence, Interpretation, and Recommendations

Of the 96/200 that brought up leadership:

- 12 “Academic”
- 20 “Nonprofit”
- 30 “Private Startup”
- 22 “Private Scale”
- 2 “Private High-Growth”
- 8 “Private Mature/Corporate”
- 1 “Public Sector” city
- 1 “Public Sector” county

Of the 96/200 that brought up leadership:

- 9 aged 20-29
- 29 aged 30-39
- 27 aged 40-49
- 16 aged 50-59
- 8 aged 60-69
- 1 aged 70+
- 6 age N/A

Of the 96/200 that brought up leadership:

- 32 Female
- 63 Male
- 1 Nonbinary or Other

Of the 96/200 that brought up leadership:

- 5 African American
- 11 Asian
- 2 Latinx
- 1 Multiracial
- 77 White

Of the 96/200 that brought up leadership:

- 2 High school
- 37 Bachelors
- 38 Masters Level
- 5 JD
- 12 Doctorate Level
- 2 N/A

The word of "leadership" is cross-cutting and is truly applicable to PART's other chosen themes in Capital, Talent, Strategy, and Data; but we too chose to specifically highlight regional leadership for distinct two reasons: 1) our study participants focused so much on how leaders could be working towards helping the innovation and emerging-technology ecosystem, and in equal parts, how the ecosystem could do a better job of helping equip local leaders and decision makers with more tools and knowledge about the ecosystem; and 2) who else can one ask for help to make progress and growth a priority?

Leadership in our region has been monumental on several occasions over the years in pulling the economy back from the brink as has been already discussed, and according to a state of Pennsylvania economic development official "[Pittsburgh-area] leadership is easy to work with, and it has contributed to changing the reputation of Pittsburgh over the last 40 years."

But there is more work to be done.

Leaders in Pittsburgh were often encouraged by participants in our study to be more engaged, collaborative, and most importantly, transparent, in their thoughts and actions relative to the innovation and emerging-technology ecosystem. How leaders focus on honest methods for growth will be vitally important over the next decade. At times they surely might not know how to display this transparency, know where to go to share ideas or obtain opinions, or generally be an effective communicator even if known; but in the end, decisions--including investment and management decisions on strategies to grow the innovation and emerging-technology economy--need more accountability. A local entrepreneur (who happens to be female, a minority, and from an untraditional background) described Pittsburgh as the setting of the popular Broadway play Hamilton, playfully, but seriously quoting the lyrics:

> "No one really knows how the game is played
> The art of the trade
> How the sausage gets made
> We just assume that it happens
> But no one else is in the room where it happens"

PART highlights leadership below in a few ways, but most heavily on a medium to develop tomorrow's leadership throughout the region. Specific next steps that resonate with our research and what other ecosystems are doing may be:

Recommendation 1:

Engage current leadership to take part in accessible forums and mentorship programs that give proactive opportunities to connect to young talent and future leaders.

"We don't need more convening organizations, but an honest-to-goodness real consortium of current and future leaders talking about 'what are we trying to accomplish here in the Pittsburgh region's innovation and emerging-technology ecosystem. Really, and collaboratively."

This quote, as told by a management consultant who is deeply involved in the technology ecosystem, captures the scarcity mindset expressed by so many in that "if it's not my idea, it's not a good idea." Current leaders in Pittsburgh have a unique pedestal and opportunity to ensure their ideas are sustained for the future based on the market composition of ease of partnerships and cross-collaborations, but more effective outreach and education should help fuel this to develop leaders of tomorrow.

Recommendation 2:

Develop a specific program for developing early- and mid-career talent in innovation and technology.

Pittsburgh has historically been blessed with a strong private sector leadership in influential and multinational corporations, but a direct crosswalk between these leaders' entities and the local economy remains underdeveloped.

In Pittsburgh, PART struggled to identify anyone who could cogently answer the question "How do we truly connect older companies with the newer ideas? And how does the great local research and development that's happening here fold into the local community in a truly meaningful and truly impactful way?" These answers clearly start with leadership and engagement of the proper talent, and furthermore, hinge on more places and venues for the co-development of this talent to spark the local innovation and emerging-technology ecosystem.

Recommendation 3:

Invest in regional assets that make Pittsburgh exciting to young and diverse populations, such as cutting-edge arts programming, event series, neighborhood walking districts, and hobbyist spaces and communities.

As Pittsburgh continues to navigate rocky waters that existed prior to the COVID-19 pandemic, and only made more turbulent throughout the last eighteen months, attracting and retaining a stronger, younger urban presence to create energy for new discoveries and new beginnings will be critical. Summed up by Ryan Gent of the Pittsburgh Technology Council, "we need to focus on selling Pittsburgh as a place to live in aggregate, not just as a place to locate an office. We have great amenities here and a growing plethora of tech jobs to attract people, we just need more of those like-minded, driven people."

Recommendation 4:

Engage university populations in more city affairs to bind their interests to what's happening in Pittsburgh.

We did hear in exciting fashion that the seemingly endless possibilities on local college and university campuses for student entertainment and connections is so robust today, that students don't have to get involved in the local community if they don't want to. There are clearly multiple reasons why students choose to leave the city upon graduation, and this is certainly a contributing factor. All sectors must take up the charge to show greater interest in both students as well as subject matter experts so that campuses, regardless how near or far from the city's limits, do not allow metaphorical moats to be built.

Recommendation 5:

Build training and workforce programs that springboard people into tech-adjacent roles to help grow the indirect technology economy. For instance, jobs in fields such as project management and data labeling.

Recommendation 6:

Create delegations that intermingle with talent and leadership in other cities relevant to our region's goals.

A clear way to help spur and sustain growth is to learn how other cities and regions have had success in doing it themselves. There are countless instances where small, medium, and large groups from the Pittsburgh region set off on benchmarking and meeting-attending journeys, some of which even directly or tangentially influence the local innovation and emerging-technology ecosystem. Yet, this research shows many of these are one-off, not in a coordinated fashion with resource sharing in mind, and certainly without community debriefs to leverage and build upon.

If Pittsburgh wants to grow its local prowess, capturing best practices and lessons learned from others--again, in a centralized way--would be a humble place to start.

THEME 3: TECHNOLOGY EDUCATION AND WORKFORCE PIPELINES

Pittsburgh must invest in broad technology education and expand workforce development programming to boost talent

Overview

There is a good reason why entire nations as near as Canada and as far as China are mobilizing efforts to educate large swaths of their citizenry on emerging technologies: it's the only way to guarantee a place in the future global economy. According to Forbes, China is now arguably the world's "First Artificial Intelligence Superpower" (11) with its rapid scaling of technology research, while a strategic shift in Canada's macroeconomic policies has seen the country directly invest taxpayer dollars into artificial intelligence fields to the tune of $750 million just since 2016. (12) Here in the United States, the U.S. Bureau of Labor Statistics projects employment to grow more than 10% in the next decade in computer and information technology occupations alone. (13)

> Inevitably, the single best solution for a city, region, or our entire country to propel an innovation economy forward is to have a talented population and civic population that are literate in the technologies of the time and exposed to the technologies of the future.

11. Forbes. "China – The First Artificial Intelligence Superpower." 2020. https://www.forbes.com/sites/cognitiveworld/2020/01/14/china-artificial-intelligence-superpower/?sh=7900beea2f05
12. Radical Ventures. "2021 Primer: Canada's AI Research Ecosystem." 2021. https://radical.vc/2021-primer-canadas-ai-research-ecosystem
13.U.S. Bureau of Labor Statistics. "Computer and Information Technology Occupations." 2021. https://www.bls.gov/ooh/computer-and-information-technology/home.htm

Important to any strategic emphasis on education--which here includes both the K-12 system, as well as professional and civic education--is that it must cover a broad spectrum; else it will fall victim to focusing on an area of success and turn a blind eye to vast weaknesses. As the COVID pandemic made clear, when schools, organizations, or municipalities fail to diversify or practice inclusivity, a digital divide erupts. To buffer against these fault lines, as well as proactively embrace the future, a full suite of technology education must be on offer and widely accessible throughout any innovation economy, starting with basics such as reading, touch typing, using search engines, and mastering graphic user interface (GUI) menus, and stretching all the way to training individuals to become specialists in cutting-edge fields such as Deep Learning, Computer Vision, and Augmented Reality. To be blunt, talent development all starts with proper education of any sort.

Education

Our research exposed a need to improve technology education in a variety of areas as a component of talent development. Over 50% of our data points indicated some discussion of weaknesses in technology education or literacy across our city, which in turn diminishes the power of our workforce pipelines. Some of the core categories with room for help that PART observed here included local K-12 curriculum being antiquated for the times and according to one interviewee, “missing even basic universal infrastructure to even accept help or outside pilot programs, thus hindering direct bridge-building to the technology economy”. This fact recognizes that a significant number of schools both in our metro area as well as the surrounding counties are under-equipped in human and financial resources, thus perpetuating massive inequality of access to technological tools during formative schooling years.

In another area, even local Colleges and Universities with ample resources seem to focus a bit too much on hard coding skills and not enough on application development and the business aspects of technology needed to actually create companies and jobs. With all of the advanced and emerging technology capabilities and potential we have within our region--especially in our higher education institutions, let alone in K-12--we need look no further to see how Pittsburgh fails to crack even the top-30 in the Times Higher Education list of “Top Cities for Digital Education and Careers”, with domestic competitors like New York, Boston, Los Angeles, San Francisco, Chicago, Atlanta, Washington, DC, San Diego, Miami, Seattle, Denver, Research-Triangle cities in North Carolina, Baltimore, and Austin all ranked higher for providing a digital education and encouraging technology skills and entrepreneurship. (14)

14. Times Higher Education. “Digital Leaders: top cities for digital education and careers.” 2021. https://www.timeshighereducation.com/student/best-universities/digital-leaders-top-cities-digital-education-and-careers

Technology Ubiquity

If one is to look outside our region, especially to comparable or larger domestic metro areas or abroad, one is likely more able to also find computational design and technology are progressively baked into modern cities and households; yet outside of certain small enclaves in Pittsburgh, these signs of being “tech forward” are scarcely found in most neighborhoods.

One of the more interesting and tangible findings that our research uncovered was the disappointing feeling of a scarcity of technology in general in our region, most importantly few spaces to tinker and be creative or inventive with technology in a hands-on fashion across neighborhoods. In addition, as the COVID pandemic unfurled itself, massive donation drives throughout the region sprung up causing many to take notice how many homes had too little or no access to computers or even broadband internet. These realizations and subsequent efforts pointed to a local blind spot to the many who felt the smartphone and 3G/4G revolutions had lessened the local digital divide.

Beyond necessity, even for hobbyists for example, where does one go to locally learn about virtual reality; to access or gain skills with products like Adobe; or directly see the major innovations occurring in animation and graphics? (15) In some of the aforementioned domestic cities, and certainly abroad in places like Singapore, London, Tokyo, and Hamburg, it is at times easier to find technology and innovation hubs than bars and banks. If a large swath of a region’s population cannot locate a place to see a sample of emerging technology, it isn’t a far stretch to proclaim they will likely have difficulty playing a role in economic solutions that propel these technologies.

15. PART in no way is attempting to diminish great work by organizations or endeavors such as Hack Pittsburgh or Protohaven, but rather highlight the need for more across the board.

Population

The elephant in the room for the Pittsburgh region is certainly the aging demographic, declining population, and outsized participation of a workforce employed in industries largely destined for automation or outsourcing, all of which contribute to a general miscomprehension of where technology is now and will be tomorrow, and all of which have been discussed by entities like the Brookings Institution and Allegheny Conference on Community Development in recent years. Even more recently, One America Works provided Pittsburgh an opportunity to help approach this elephant in part by "pitching" itself to tech talent across the country (and, unsurprisingly, "connectivity" was subject matter).

Despite this recognition by some, and even with impressive efforts in fields like advanced manufacturing underway, one of the largest barriers to developing workforce programs is actually going into communities and galvanizing the interest in these career pathways. Why? Because most people just don't know what the future of work is supposed to look like, and they haven't had anyone locally invest deeply in that research for wider publication, nor directly in their nascent skills to learn.

In Pittsburgh's more affluent communities, too, there is great evidence from local technology companies (large or small) or those looking to enter the market searching for talent and leadership that tells us individuals are not actually comprehending or even conversant with the major themes of technological change. This research project produced an astounding number of data points where high-level individuals operating across all local sectors of the city and with funding or decision-making authority fail to grasp both the general power of emerging technology for our innovation and technology economy, as well as how to align their thoughts and publicly discuss it to highlight the jobs of tomorrow.

This reality, though omnipresent throughout this report, links forcefully back to Theme 1: Capital Channels for an Innovation Economy and the notion that even local investors may be in need of some education around the emerging technologies and the adoption life cycles of successful innovations. And similarly at the public level, higher understanding and adoption could provide the chance to catalyze downstream effects for citizens or overlap collaboratively in other sectors, including more opportunities for public-private partnerships. Ultimately, a move towards proactively vs. reactively aligning Pittsburgh with emerging trends.

Evidence, Interpretation, and Recommendations

Of the 105/200 that brought up talent:

- 8 “Academic”
- 20 “Nonprofit”
- 31 “Private Startup”
- 22 “Private Scale”
- 9 “Private High-Growth”
- 13 “Private Mature/Corporate”
- 1 “Public Sector” city
- 1 “Public Sector” county

Of the 105/200 that brought up talent:

- 15 aged 20-29
- 37 aged 30-39
- 24 aged 40-49
- 10 aged 50-59
- 6 aged 60-69
- 0 aged 70+
- 13 age N/A

Of the 105/200 that brought up talent:

- 30 Female
- 73 Male
- 2 Nonbinary or Other

Of the 105/200 that brought up talent:

- 1 African American
- 11 Asian
- 0 Latinx
- 1 Multiracial
- 92 White

Of the 105/200 that brought up talent:

- 4 High school
- 37 Bachelors
- 45 Masters Level
- 4 JD
- 14 Doctorate Level
- 1 N/A

In this section dedicated to boosting talent through expanded workforce development programming, PART also chose to highlight education, notably local technology education. Generally, interviewees and survey respondents tended to lump them together, though we know from widely respected research and general investment avenues and practice they are separate. (16)

Coupling this with the struggle to attract talent from beyond our region, creating a diverse workforce, including one that diversifies and expands beyond the technology economy, is a concern for the region's growth and poses significant risk to underappreciate--or totally miss out on--presented opportunities.

Fortunately, throughout the course of this research study which stretched between 2020-2021, more efforts and investments have occurred throughout the Pittsburgh region in the name of "workforce development." This includes attempting to build upon the success of the Pittsburgh Passport program, and new work announced by the Pittsburgh Regional Alliance around a targeted approach to entrepreneurs, students, and remote workers. Rather than debate the specifics on what any workforce development program should exactly have, our view is there should be a more holistic view about "workforce development" in the region, versus piecemeal initiatives (which, too, need increased).

As someone who just moved back to the region after many years in Washington DC described to PART, "Lack of free or affordable, two-year CTE degrees; limited and disjointed investments into early STEM education (K-8); absence of Pre-K for all/affordable childcare options; a failure among city, state, and federal leaders to compel the tech industry - whether it be through tax reform, antitrust reform, etc. Pittsburgh needs to invest in our communities and the capable workforce housed within them, and address woefully inadequate hiring practices."

Bottom line: Pittsburgh can improve on diversifying its workforce, not just by race, but also by skill and level of experience. It is clear that a broad-spectrum education and workforce development effort is a mammoth (perhaps some would say impossible) undertaking for a city Pittsburgh's size and makeup; however targeted initiatives in a collaborative fashion could make a world of difference in upping the general technology literacy of our local population. We see the following opportunities to make improvements:

16. There were certainly instances where a study participant would bring up the lack of available talent in the Pittsburgh region without noting specifically it was due to a lack of local educational opportunity. In the reverse, at times explicitly mentioned but in other instances more inferred, study participants indicated they believe insufficient technology education in our area is certainly having a ripple effect on the talent produced for the technology economy.

Recommendation 1:

Investing in professional development for teachers and out-of-school time (OST) instructors to gain knowledge and skills of what's changing in technology.

Starting at the earliest stage of this remediation is the need for greater K-12 technology awareness and education. After speaking with multiple parents who have children in the public-school system it became evident that there is no clear, ubiquitous path for all students interested in learning more about the basics of technology. Certainly there are some public, private, charter, and other schools that are equipped with human or financial resources to offer great support and education. But in other situations, schools are reduced to teaching simply the basics of technology education, if anything at all. Many teachers haven't been given the tools or chance to obtain the necessary skills set to introduce relevant topics or facilitate their exploration and tinkering of ideas.

One local tech entrepreneur wished there were more direct throughputs to get high-schoolers involved directly in the start-up scene in Pittsburgh to see what's possible, let alone help. Paraphrasing, the entrepreneur went on "I absolutely need a college-trained artificial intelligence engineer for my company, but equally important would be a high school graduate with a 12-week coding boot camp to also help. They'd get exposed to the technical work of the engineer and the professional skills that people need, so the region should dedicate programmatic dollars on supporting our young learners and entrepreneurs at the same time growing our people and our businesses."

Additionally, a local roboticist described a personal story that resonated and displayed the situation so many struggle with. Sharing that his son was interested in robotics, he was saddened to see that advanced support for K-12 students in this field wasn't as robust as other domestic markets. Citing the outdated need to build an infrastructure that links K-12 students directly with the local technology industry, the roboticist noted that local colleges and universities are pivotal in being able to help students understand the exact type of math problems, for example, you should understand to work in robotics. Or, help students understand that robotic techs are also a necessary job, that you don't always have to have a PhD, and overall, more work and help could be offered to help support the local curriculum. The story ultimately ended with "if I didn't personally know how to steer my son, he would've been lost and likely never entered a tech field."

Recommendation 2:

Establishing more technology hub destinations, particularly in lower-income communities across Allegheny County. That is, spaces with computer labs, technical tinkering, hacking clubs, video game and app development sharing, and education opportunities.

Pittsburgh would benefit with tangible and intangible steps taken to establish technology hubs that physically (and emotionally) bridge communities and neighborhoods. Beyond offering hard, physical assets in places where youth, especially from underserved communities, can literally learn and tinker, verbally tearing down the stereotypes of technology jobs and computer science education is equally important. These steps would likely be as empowering and influential as the time and energy spent on coding boot camps across the region.

Recommendation 3:

Fund and sponsor after-school programs that infuse technology literacy and access across programming both in and out of STEM activity areas.

The City of Pittsburgh is doing a good job at recognizing the potential of its local assets, but more work (and consultation from the technology community) is needed.

Itha Cao, formerly one of the City of Pittsburgh's dedicated employees in Innovation and Performance suggested the city would like to find better ways to partner with recreation centers and after-school programs (especially for lower income populations) to provide technology literacy, education, and help shed light on direct paths to internships, jobs, and other education options." PART fully supports this idea, most notably due to a successful model such as this in other domestic metro areas.

Recommendation 4:

Expand and guarantee basic access to WiFi in our under-served communities.

Recommendation 5:

Work with local school districts to upgrade basic technology equipment.

Recommendation 6:

Create interest forums, educational conferences, and events targeting local leadership that expose them to trends, breakthroughs, and success stories of how technology is changing business and what innovations are emerging globally.

One of the most important endeavors the Pittsburgh region can do for itself is ensure it knows and understands exactly what is happening on its own doorstep. Professional education and community stakeholder education programs that explain the region--internally, and to external audiences--as well as bringing outside innovation from across the globe back to the region is indescribably important to grow the region. There are already some great resources, like FutureGrind, the Pittsburgh Technology Council podcasts, Chamber of Commerce and local politician newsletters, but more and more are necessary.

Two important points: first, while local, state, and federal governments are slow to develop advanced regulations that govern many innovations in the emerging-technology industry, including in artificial intelligence, ensuring the proper infrastructure is in place to communicate benefits is dramatically important. A state of Pennsylvania official requested that Pittsburgh take more of a lead in this area, citing the city is extraordinarily reputable in being able to educate broader society (including outside of Pennsylvania) about the merits of technology and its economic, public health, and sustainability benefits. Second, the majority of people in a region such as Pittsburgh's--and many other regions for that matter--simply don't comprehend how important high-tech jobs are because they are not data scientists, developers, or computer engineers. Educating the population in general would bring them up-to-speed to not only participate, but legitimately help facilitate growth.

Recommendation 7:

Catalyze social hubs that are tech forward such as gaming clubs, e-sports leagues, AI collaboration groups, technology art meet-ups, etc.

Recommendation 8:

Alter the perception of various local philanthropic institutions that sufficient education pilots already exist in Allegheny County and the surrounding counties in SWPA.

Never has a statement been truer that the Pittsburgh region is blessed to have the effervescent presence of its philanthropic foundation community. Other players in the region should help these organizations by building initiatives that offer a more meaningful connective thread between themselves, local colleges and universities, private companies, and ultimately the local public-school system here in the surrounding counties of southwestern Pennsylvania. A tangible example is in the idea of workforce boards: several local leaders referenced how the state of Ohio is training students directly in advanced manufacturing found particularly within its state's borders, and expressed the same program be jump-started and further supported here.

THEME 4: REGIONAL AND NATIONAL STRATEGY

Pittsburgh must design a well-communicated regional and national innovation and technology economy strategy

Overview

Without a shadow of a doubt, for the Pittsburgh region to maintain wider relevancy and generate greater prosperity in the decade(s) to come, it certainly must start, continue, and accelerate areas of internal realignment to produce a strategic "fitness and compatibility" with a larger geography and evolving economy: in the City, tri-state area, select regional partnerships, and the nation going forward in general.

By now, the story has been written about and preached many times over on how the rise of the City's historical industries literally built the world, and in equal measure, the fallout from these industries' decline (notably steel) ran the gamut of decimating the socioeconomic status of the region.

Though the scars of the unfortunate times are still visible today, such as in real estate (e.g. brownfields and vacant buildings); the environment (e.g. air and water pollution); the infrastructure (i.e. bridges and a sewer system in disarray); or the census data (i.e. continued net population decline since the middle of the twentieth century), it is true that for most of the citizens in the Pittsburgh region today--whether generational Pittsburghers, transplants, or boomerangs--things could have been much, much worse.

Luckily, as described earlier, countless leaders and multiple cross-sector initiatives recognized that for the city to have a shot at a multi-generational rebound, a "reinvention" strategy was necessary--thus the pillars for the "Eds and Meds" economy were propped up to buttress our region's medical and educational prowess.

Rather than recount the history, or diminish the power of "Eds and Meds" as simply a mantra of yesteryear formed from the postindustrial era (a position expressly taken by many study participants) it is much more useful to deeply assess lessons learned, be honest that it isn't the only piece of the puzzle to further generate positive attention and investment for our region, and use select parts of the model to create a corresponding transformation for what Pittsburgh will become in the rapidly-evolving innovation and high-tech future around the world.

Depending upon one's current position or vision for the region, PART recognizes that strategies or even phrases like "Eds and Meds" today actually have negative connotations for a lack of forward-thinking vision, and other participants vehemently argued that industries with "sustainable" paths should receive heavier focus.

> Regardless, what is crystal clear is that our region has a treasure trove of assets and opportunities, but no entity has drawn a comprehensive treasure map.

A final note prior to delving deeper into strategy: first, this research clearly indicates that separate, but interlocked strategies need development at the regional level and national level. Indeed, identified steps may be necessary just at the local level; at a level looking outward to ultimately benefit inward; or certain steps may need to be executed at both levels. What is clear, however, is a regional and national strategy needs to inform one another and be complementary. Second, apart from the glaring need of systematic strategy development, in harmony there must be better internal and external communication. PART chose to not highlight communication (marketing/advertising/branding/etc.) in great detail in this report as either a theme, subtopic, etc. because it was actually mentioned in nearly 100% of our data points. Thus, it is given that this is an area for improvement known by many and PART supports all efforts trying in this regard. Summed up succinctly by a prominent local roboticist: "Pittsburgh needs to market itself better; wins are not known outside of the city or appreciated, and actually there are those that even discourage promotion." Or expressed another way by a member of the local technology media industry "Pittsburgh is bad at telling its story. We need to do a better job at telling the stories of new investments. More stories, more attraction from like-minded individuals. Marketing and attraction are an endless loop."

Localism

According to study participants, and actually observed in other PART research projects (17), the absence of a comprehensive, collaborative, and clear regional strategy to organize, advertise, and harness the potential of our innovation and technology economy is bringing about two disparaging problems that many local stakeholders perceive as weaknesses to operating in Pittsburgh: 1) Regional players are not engaging with partners outside the region for talent, capital, or customer development; and 2) Regional players lack focus such that the region's efforts feel spread or isolated, and stakeholders don't know where they fit in to a broader, long-term direction. Simply put, there is great potential to build a denser or more connected innovation and emerging-technology ecosystem, and it starts with strategy.

Simply put, there is great potential to build a denser or more connected innovation and emerging-technology ecosystem, and it starts with strategy.

17. Such as on behalf of other private sector entities and philanthropic foundations.

These sentiments lead us back to the same concerns about so-called parochialism and shuttering from external partnerships and collaboration that may be necessary to fully catalyze our ecosystem. Oddly, we heard from interviewees that the seemingly harmless “are you from Pittsburgh?” questions common in nearly every icebreaking situations has actually further ingrained the strong pull to work strictly within the region. Call it subliminal blue-bloodedness. “Pittsburgh’s deep mistrust of outsiders puts decision-making in a small pocket, without the right folks at the table” a local leader--who is very much at the table--explained to PART.

However, it has become clear that not engaging individuals and entities from outside comes at a huge expense to the region, and if reversed, could be hugely beneficial to multiple companies, notably the startup community. Customers, entrepreneurs, inventors, investors, and taxpayers are just a few groups often left behind not just in decision-making, but in understanding what direction our region wants to go in, too. A common qualifier to many of these data points often came in the form of “in Pittsburgh, it usually isn’t malicious, it is just really easy to fall back on who you went to high school with.” As a result, as a local venture capitalist declared “Pittsburgh then only tends to look at the regional market, and rarely goes for that global, game-changing idea.”

Identity and Focus

Pittsburgh should shout from the rooftops that we are the world's leading AI city!" proclaimed one study participant over Zoom working at the intersection of several industries; but many others expressed confusion or doubt on whether the city truly wants that identity or not. The overarching sentiment is that if Pittsburgh leans too hard into its technology (and AI specific) potential future, it will displease others in older or traditional industries, or even the healthcare, finance, philanthropic, or other industries where there is still a gap in understanding how to fold in emerging technology into operations. Regardless of setting aside mutual exclusivity, there is tremendous worry across sectors that a forward-thinking economic narrative is a touchy, even alienating subject, and hesitancy pervades to go too far in this (or any) direction.

What's clear, however, is the lack of focus has led to missed opportunities for Pittsburgh to brand itself. "Pittsburgh should strive to focus hard on a few areas, so TechCrunch, CNBC, Forbes, Inc., etc. notice and report that 'those are Pittsburgh things!' like responsible technology, robotics, or others'" said a local philanthropic leader.

Throughout this study's duration, "focus and strategy" became validating for other themes, given the direct relationship to concerns around capital, leadership, talent, and data. Rationalizing here each theme against one another forms a coherent story as to why we may be lacking a regional and national strategy that would give our ecosystem structure and catalytic capacity.

For example, regarding capital, if one posits that Pittsburgh does not have the right investment dollars ready to deploy, and people are already looking outside the region for investors, capital attraction emerges as an immediate and obvious need for considering regional partners. Indeed, many investors prefer to be geo-located with their investments, so nearby investment and equity firms such as those in Washington, DC, Columbus, Philadelphia, and New York City may play well with a Pittsburgh company. Correspondingly, many start-ups believe that the potential of their companies is assessed based on their perceived ability to work with major local customers. This problem may be ameliorated with a better strategy, on one hand, to activate channels for making warm intros to external clients and, on the other hand, for building up an internal technology economy with a portfolio that organically builds off itself (i.e. growing strong businesses that are likely to do business with one another or amplify one another's offerings).

Without a clear and thoughtful strategy, it seems we may continue to miss opportunities to build internally and be passed up by external stakeholders looking to make meaningful partnerships. Given what we know about demographic trends and the current size of our technology economy, it clearly indicates that new talent and partnerships will be necessary to keep up with other cities. As the IW report shows, while we are still in the middle of the pack with other cities looking to grow innovation economies, the percentage difference between us and those cities just beneath us is thin. Meaning, smart strategies in other cities could rapidly put us in a less competitive position. This means our local private and public stakeholders need to be in alignment and we need clear external partners that help amplify the strong companies in our ecosystem. Right now, too little technology transfer is occurring and we're not generating employment numbers, in part because too few technology companies are actually started and grown here. Our research suggests that part of this reason is that people don't have good answers to why they should build their company in Pittsburgh and they don't see a strategy creating confidence that Pittsburgh will be able to capitalize on opportunities going forward. The sentiment remains that talented individuals in Pittsburgh have little to do but stay tethered to a highly-vested institute like CMU and that the city writ-large does not have much opportunity to advance new innovations.

As for marketing, branding, and communicating any strategy, though PART will defer to the professional organizations attempting to generate impact here, it is worth noting quickly that widely held is the belief that our city and regional marketing could be better synced across entities, include missed opportunities to either promote or try and attract ideas like "talent", and more inclusive to diverse stakeholders in general ideation.

As we find technological innovations like AI becoming a focal point of nearly every industry's modern transition, Pittsburgh stakeholders wonder if our region is ready to get behind the game-changing ideas that will ultimately surely transform the economy. And if we are to begin engaging more national and international partnerships, Pittsburgh needs to be clear on what our message is to the rest of the world; and our strategy for engagement.

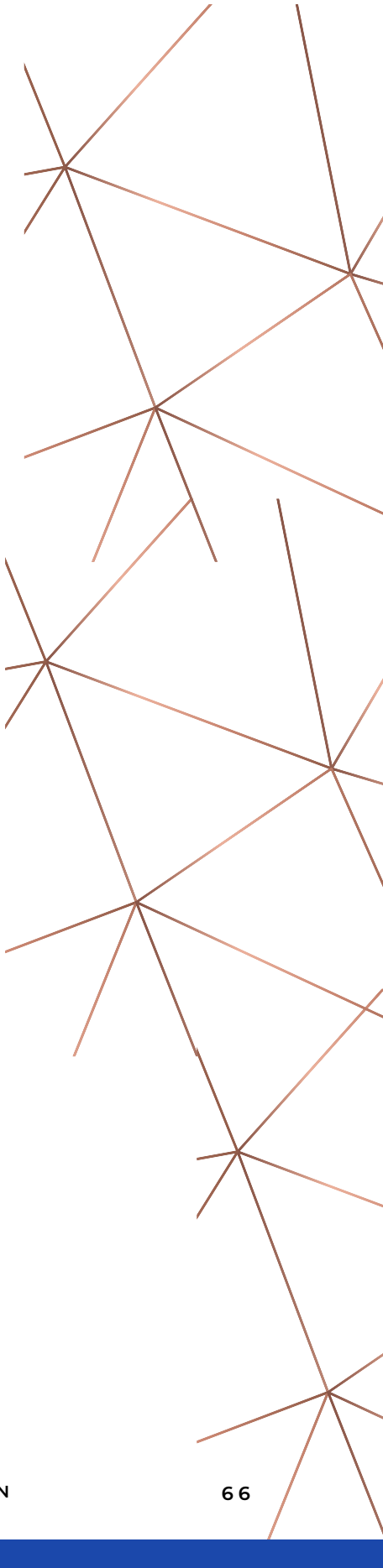
Our research suggests that part of this reason is that people don't have good answers to why they should build their company in Pittsburgh and they don't see a strategy creating confidence that Pittsburgh will be able to capitalize on opportunities going forward.

Customers

In its 2017 report, the Brookings Institute recommended programs related to “First Customers” as an excellent way to spark innovation in and around the Pittsburgh region. Additional local efforts, notably via organizations like The Hillman Foundation, Innovation Works, and a few others were started, but were too short lived to be able to alter any business culture mindset changes or measure any true success.

Yet, countless times in PART’s research we heard: where are the first customers? Where are the beta testers? Where are the risk takers? Where are the “champions of innovation” beyond cheerleaders, but real investors?

As much as companies and industries express they want talent to build internal capacity, they should want to engage with some of the great ideas internal to Pittsburgh and already here, too. This topic also dovetailed into two other subjects widely discussed elsewhere in this report--the relative success of others markets in this regard, like the Cincinnati example, as well as the “innovation spectrum” where in Pittsburgh, there is a large disconnect between technologies attempting to enter the market--internally or externally--and a corporate partner, or even as simple as entities handing-off ideas throughout the marketplace.



Evidence, Interpretation, and Recommendations

Of the 143/200 that brought up strategy:

- 11 “Academic”
- 33 “Nonprofit”
- 36 “Private Startup”
- 30 “Private Scale”
- 8 “Private High-Growth”
- 22 “Private Mature/Corporate”
- 1 “public sector” city
- 1 “public sector” county
- 1 “public sector state governments

Of the 143/200 that brought up strategy:

- 15 aged 20-29
- 52 aged 30-39
- 37 aged 40-49
- 21 aged 50-59
- 6 aged 60-69
- 1 aged 70+
- 11 age N/A

Of the 143/200 that brought up strategy:

- 46 Female
- 95 Male
- 3 Nonbinary or Other

Of the 143/200 that brought up strategy:

- 5 African American
- 13 Asian
- 4 Latinx
- 2 Multiracial
- 119 White

Of the 143/200 that brought up strategy:

- 3 High school
- 49 Bachelors
- 60 Masters Level
- 10 JD
- 19 Doctorate Level
- 2 N/A

Focus! In a single word, countless study participants described to PART what our region's innovation and emerging-technology economy is missing. We described earlier in this report how the ingeniousness of historical leaders in the Pittsburgh area had the foresight and gumption--obviously in many regards not given a choice, but let's not short-change the work--to begin a culture shift to invest in growing the education and medical components of our economy. Now, we need something new.

It isn't abnormal to cast a wide net and probe multiple options when thinking about where to dedicate resources and make investments, but PART (and nearly 3 out of every four study participants) agree it is time to double-down on a few select areas and simultaneously erect a collaborative, regional strategy to build Pittsburgh's premier innovation and emerging-technology economy.

Described to PART in multiple ways by multiple parties (all 9 sector sub-categories noted this to be an issue), in essence study participants believe Pittsburgh's usual collegial and humble nature are holding us back; that as opposed to creating a realistic and collaborative environment to build an honest and targeted regional strategy, that too much "pandering", "pleasing all parties", "risk of offending", "watering too much of the garden", and "placating historical individuals and business agreements" holds the region back.

Regardless of however many missteps, missed opportunities, or misfortunes have befallen the region, PART is confident Pittsburgh is still poised to capture the moment for expanded growth--for more than just a select few--so long as regional leaders act fast, creatively, and intelligently through building the first real regional strategy for economic growth.

At the highest level, PART suggests 3 options here:

1. Pick a cross cutting technical topic (like robotics and AI) and definitely play up how it's applicable to all industries, like finance, healthcare, energy, and beyond.

2. Investigate niche opportunities. For example, although Pittsburgh is viewed as one of the medical capitals of the world, there's no debate that it is not "the" medical capital of the world. And the same goes for life sciences. Leaving out the contentiousness that the underperforming success of the industry evokes across members of the innovation and emerging-technology ecosystem (and beyond, actually), there's no doubt Pittsburgh can indeed make itself the world leader in various niches within life sciences. For example, in vision- and neuroscience, peptides, or cellular therapies

3. Harness an umbrella or macro thematic topic, such as "responsibility." The "Responsible Technology Capital" is an unclaimed title in the world, and one that Pittsburgh is actually in a strategic position to ascend to.

143 of our 200 data points specifically mentioned perceived weakness around regional strategy. Some of the common major talking points we regularly heard were: 1) it's too hard to get first customers in Pittsburgh. The larger private sector should take more risks and not leave everything to the philanthropic community. We also need coordination to find pathways to external clients; 2) internal companies in Pittsburgh are not collaborating with each other enough to stimulate technology economy; 3) there is too little competition amongst accelerators and incubators to really push beyond status quo toward significant new innovations; 4) poor vertical integration and full-stack solutions on key efforts leave disparate solutions and gaps; 5) branding the story of Pittsburgh continues to remain challenging, unfocused, and even uninspiring externally, and even internally and externally; 6) a missing public-sector innovation strategy to act as the tip of the spear for our region's direction.

Similarly to how nearly 100% of our data points mentioned communications shortcomings, nearly 100% of data collected can directly or indirectly be attributed to some form of strategy. As such, PART's recommendations on this theme in particular are quite pointed, and leave little space or need for further contextualization:

Recommendation 1:

Work with local stakeholders to identify a small number of focus areas for the innovation economy--quality not quantity. Determine key sectoral verticals within the ecosystem that complement one another and integrate investment, training, and business development pipelines.

Recommendation 2:

Agree upon a single, clear, regional brand narrative to share internally and externally across the globe. This involves collaboratively identifying the leading entity to design the campaign; includes all parties (especially the technology community); and generates a universally accessible platform or repository where any individual or organization may access templates, boilerplate language, tools, or portals of communication to ensure coherent and common messaging. It should be as evergreen as possible, but also be routinely reexamined. Be bold and loud!

Recommendation 3:

Identify key partner cities or regions to develop mutually beneficial relationships for lowering barriers to shared investment opportunities; opening new offices; student internship opportunities; delegation exchange for shared learning; and ultimately connecting companies in the technology sector to potential clients (bi-directional in and out of the Pittsburgh region). Here, the AI Triangle is an example, but there are other areas for focus as well.

Recommendation 4:

Develop internal capacity and secure multi-sector buy-in to build a long-term and sustainable first-customer program through creating incentives for participation.

Recommendation 5:

Create transparent inventory of companies that are visible externally to lower due diligence of potential investors and increase local procurement opportunities that may be accessible internally and externally to our region.

Recommendation 6:

Build forums and communication channels that synthesize the Pittsburgh technology story and better disseminate information about new opportunities, successes, and future directions of the innovation economy.

Recommendation 7:

Connect the public sector with technology liaisons who can aid in the development of a public sector innovation strategy and ensure emerging technologies are understood by public offices and officials.

THEME 5: CLEAR AND TRANSPARENT METRICS AND DATA

Pittsburgh must maintain leading organizations with transparent metrics and are strong with data sharing and archiving

Overview

In today's modern economy, it's increasingly clear that data is the most important asset one can possess and maintain--as an individual, an organization, or a connected system writ large. And with particular respect to an economy's overall viability and potential, vast amounts of clean and accessible data are critically necessary to enable advanced civic and business possibilities (such as via machine learning) and to be in a position to unlock emerging technology innovations (including through AI).

Amongst the five themes PART highlights in this report, "data" emerged as a topic not numerous in "quantity" throughout the research, but in short measure it registered as a "quality" (read very troublesome) topic within our particular region, with varying degrees of negative impact. This idea was expressed directly not only through historical and current anecdotes of missed or lost opportunities by our study participants, but in fact, larger validating bodies such as the OECD note that data access and sharing can directly generate social and economic benefits worth upwards of 4% of GDP in some studies. (18)

18. OECD. "Economic and social benefits of data access and sharing." https://www.oecd-ilibrary.org/sites/90ebc73d-en/index.html?itemId=/content/component/90ebc73d-en

Nearly 1 in 5 of PART's research participants indicated that data (what's known about other markets, but more glaringly on a local level) was an extreme pain point within the Pittsburgh innovation and emerging-technology ecosystem, with many describing it as weak. As a result, this weakness creates confusion, frustration, duplication, inaction, and dampens the overall innovation economy in its ability to inform and empower entrepreneurs, legislators, economic development officials, and regional communication professionals, amongst others. A local entrepreneur working directly within the data space put it simply: "no one knows how to use data correctly, and [local] decision-making is often playing from behind."

Even experts we spoke with who are competent at using data voiced a lack of understanding how data is locally generated, captured, maintained and stored, and ultimately used in city or region-wide initiatives. Many stakeholders indicated prior participation in project and strategy formulation, funding, and execution using simple anecdotal reasoning or "gut instincts" of power networks as opposed to data-driven reasoning and logic.

As a result, this weakness creates confusion, frustration, duplication, inaction, and dampens the overall innovation economy in its ability to inform and empower entrepreneurs, legislators, economic development officials, and regional communication professionals, amongst others.

Collectivism

So, what's the baseline issue? Notably, a missing "data community."

In line again with Theme 4: Regional and National Strategy, the glaring and ongoing void of not having an overarching, centralized Pittsburgh-region strategy around local innovation ecosystem technology research, development, and exploitation, means that individual organizations are subsequently all collecting small, disjointed data sets for their own internal purposes. Furthermore, respective organizational success metrics are not aligned within a greater network, leaving little consensus as to what we as a region should be measuring for greater economic growth potential.

High level commitments to building and seizing upon regional innovations, efficiently aiding the economy to evolve with new job sectors, creating more equitable community access to technology vs. ad-hoc programming, or even making more calculated investments in certain neighborhoods are hard to make sense of as data is scant, and local leaders do not have agreed-upon constructs and measurements that allow Pittsburgh and the surrounding counties to reality-check collective progress.

First, within the public sector, PART observed that a better resource for the City's current and future data would be a major boon for the region. In some areas Pittsburgh actually has quite robust data when compared to other cities, for example on infrastructure upgrade needs or elements required to build a smarter city such as traffic data. However, further work needs to be done to develop, collect, and manage in other areas. Investing in the human and technical capital to make sure that public projects and government agencies are able to create and share their data with a centralized body would open up a world of insights that could foster improvements in a variety of areas, especially within the powerful technology economy. While the University of Pittsburgh does house a Regional Data Center, and Institutes like Metro 21 operate at Carnegie Mellon University, there has not been a full commitment to leveraging these technical resources as part of a broader regional goal of growing our data infrastructure and transparency. One of the leading regional data officials, Bob Gradeck of the Western PA Regional Data Center, said "most data that tech companies are attempting to gather and use to solve a problem is a community asset (not a company asset) so the community that will be impacted needs to be pulled into conversations before the data is collected or used."

These deficiencies also continue downstream into our philanthropic and economic development initiatives. Funders across all sectors do not universally set requirements around data-collection, use of common metrics, or make data widely accessible or usable following project completion. Similarly, within the local technology acceleration and incubation spaces (including at local Universities), study participants elucidated that they don't understand the criteria for what ideas get accepted, or rejected. But perhaps the area with the most room for improvement, our region lacks wide-spread and detailed tracking of whether the investments made in the technology economy are paying off and whether or not companies leaving are finding success elsewhere in this vein.

Transparency

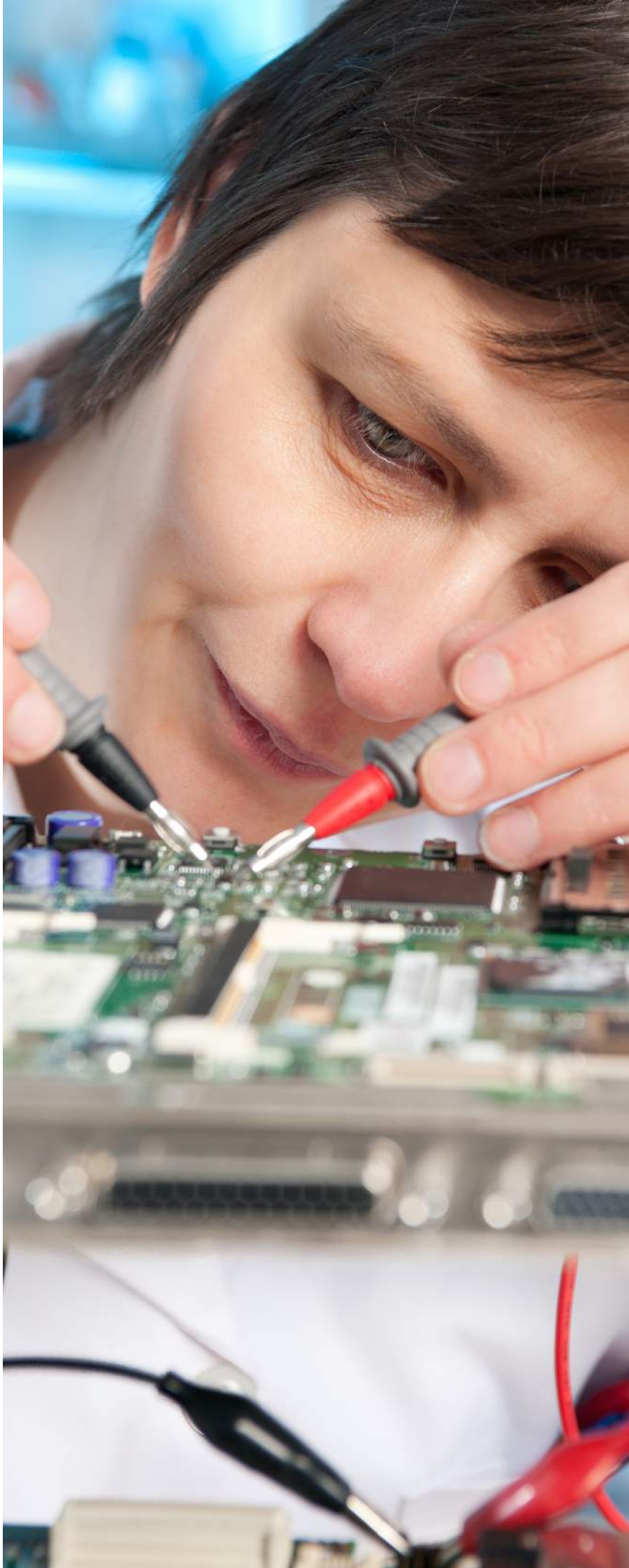
The siloed effect of not having a regional strategy or incentive structure surrounding data results in a lack of transparency and minimal use of data, which in-turn is eroding trust in processes and prevents the local ecosystem from operating with foresight and intention.

Our study participants, which again spanned all local sectors, coalesced around two separate but interrelated topics that this lack of transparency is driving. For some, it has become a deterrent for making new or additional investment of time or money into the local innovation and emerging-technology economy. For others, who haven't been quite yet deterred but are still frustrated, vocalized that this problem has actually prevented them from interlocking efforts with other companies or initiatives, or being able to be creative about how to attract domestic or international attention or investment to their causes. These sentiments, when collectively grouped, cause PART to inquire:

- Of the many studies conducted across our region--and consultants engaged, both internally and externally--to help identify regional needs, have we created a shared repository of data generated from these engagements?
- Can our region answer basic questions about our innovation and emerging-technology economy such as what is the statistical likelihood of a technology start-up making it to year 5 in Pittsburgh? And what trends precisely increase success?
- What percentage of technology companies passed up here find funding elsewhere?
- Extending beyond broad brush strokes of "goals", what are the exact target jobs (by sector, industry, number, and composition) that the region needs to create by the year 2030 to not only spur growth and avoid missed capitalization on opportunities, but to just maintain any sense of status quo?
- How many people are being trained each year who can enter the technology workforce, and at what level?
- What percentage of families in Allegheny County live within walking distance to where technology education is available to them?
- What impact can the innovation and technology economy have on our decreasing tax base?

And the list goes on. Improving upon these areas is extremely important for a City where demand for these opportunities outstrips supply in great fashion. For a vested member in a local startup that participated in one of the regional accelerator programs, broad access to minimal data and data-education was nonexistent, even for the basic business principles that "understanding data helps founders build tools that can eventually interface easily with other technologies for better efficiencies", ultimately spending less time and money retrofitting or modifying products.

Data access also opens the door to intuition and solutions, perhaps most important to the competitive positioning of the region in capitalizing on emerging technologies, machine learning and AI innovation chief among them. The Pittsburgh region has many traits that could allow it to be a leader amongst postindustrial cities looking to transition its economy into the future, and data is the proverbial sunlight that provides insight into what's holding the region back. Many innovations that are already transforming industries and are still being discovered require data to enable them. Of course, this has technical research and development notes, but the region need look no further for how global data capture and analysis can make the area more attractive--going beyond simply advertising housing costs and restaurant ubiquity--to knowing what sectors are complimenting each other in the technology economy. These, and dozens of other topics, can be better answered and implemented if local stakeholders and organizations across the ecosystem use data to structure strategy and initiatives.



Decision-making using clean data

Taking a momentary step back, having a collective and transparent approach to maintaining strategic regional data sets assumes at least baseline understanding of data and its all-around capability. But, unfortunately and semi-surprisingly, another lucid theme that arose from our study's data itself is that there is a lot of confusion and frustration surrounding data.

To be sure, there is certainly great work already being done throughout the region with data literacy and capabilities on full display. For example, a city official excitedly noted to PART the efforts of Metro21, PGH Lab, and other municipal engagements (this same stakeholder, however, went on to say incentives around the better use of data are extremely lacking). But others are harsher in their words and experiences, such as when an executive in our local incubation and accelerator industry said bluntly "ideas and investments are truly not made in this city with data points in mind. People just guess."

So how should an individual, organization, cluster, or regional ecosystem erect its data-collection infrastructure? How is it best organized, and really importantly, how is it labeled? And ultimately, how are decisions being made (or not made) based on data, and what efforts can be catalyzed to incentivize new and better data-utilization techniques as tools and force multipliers?

Regardless, to the average employee or citizen, these questions may seem either unimportant or too technical and "in the weeds", but there is a reason why LinkedIn highlighted Data Scientists in its 2021 Jobs Report as a one of the "in-demand jobs of 2021", documenting a 46% growth since just 2019. (19) It's obvious that the industry has been moving in this direction in general, but as LinkedIn notes, the COVID-19 pandemic has forced companies to lean on data and data scientists to harness current and future opportunities even more efficiently.

Understanding how data is leveraged is increasingly important for any business or regional endeavor, but in a city like Pittsburgh, with its abundant assets and potential, coupled with a culture that could take advantage of further collaboration, it is indescribably important. One of these assets, for example, that has had some success and continues to maintain grand potential, but is commonly accepted as having underperformed, is the life sciences sector in Pittsburgh. According to Christian Manders, who amongst his many roles in the city organizes the weekly BioBreakfast gathering of cross-sector life science professionals connected to the region, "the key to life sciences here and incorporating emerging technology like AI is how you collect, tag, and clean data."

19. LinkedIn. "LinkedIn Jobs on the Rise: 15 opportunities that are in demand and hiring now." 2021. https://www.linkedin.com/pulse/linkedin-jobs-rise-15-opportunities-demand-hiring-now-andrew-seaman/

These observations stemmed not only from engagements with academia and entities like the Pittsburgh Supercomputing Center, but the powerful life sciences and healthcare companies that according to Mr. Manders are “aggregating mountains of data” but struggle to put it all to use. Put most succinctly by data scientist Karen Trader, “data is definitely the "common denominator" to create more collaboration across the city and region.

Structurally, PART’s research did uncover individuals and entities that do indeed want to--or try to--use data to inform efficient decision-making, but existing data is at times porous and unreliable. This problem exists in part because there is no city-wide or universal mandate from funding recipients that individuals or entities keep a clear track of metrics or organize the data they are collecting. But even if there were such mandates, further work needs to be done to incentivize, guarantee, or ensure collaboration to avoid “quitting” on data. Again, Bob Gradeck: “data requests are one-off and not systematic or coordinated across the ecosystem; there needs to be a better way for all entities to share what data and support they need to understand community issues, design and target interventions, and track performance. There is also the need to develop organizational capacities to manage, curate, and produce data, and provide incentives to share it.”

Evidence, Interpretation, and Recommendations

Of the 37/200 that brought up data:

- 3 “Academic”
- 14 “Nonprofit”
- 4 “Private Startup”
- 10 “Private Scale”
- 5 “Private Mature/Corporate”
- 1 “Public Sector” including city government

Of the 37/200 that brought up data:

- 4 aged 20-29
- 10 aged 30-39
- 11 aged 40-49
- 6 aged 50-59
- 2 aged 60-69
- 0 aged 70+
- 4 age N/A

Of the 37/200 that brought up data:

- 12 Female
- 25 Male
- 0 Nonbinary or Other

Of the 37/200 that brought up data:

- 1 African American
- 6 Asian
- 2 Latinx
- 0 Multiracial
- 28 White

Of the 37/200 that brought up data:

- 1 High school
- 12 Bachelors
- 19 Masters Level
- 0 JD
- 4 Doctorate Level
- 1 N/A

To create alignment across regional efforts for growing and sustaining an innovation and emerging-technology economy; help attract and retain talented entrepreneurs; support a more effective and efficient regional strategy for making financial and other investments; and ultimately enable more technology innovation seeds to be planted in our region (especially in artificial intelligence and machine learning), PART suggests the following as it pertains to data generation, collection, sharing, maintenance, and archiving:

Recommendation 1:

Funders must take a stance around communicating targeted metrics and requiring data be collected and made available.

Over the past ten years, it's true that capital providers in the Pittsburgh region that are helping to catalyze organizational and economic growth such as venture capital firms and philanthropic foundations have required their funding recipients to establish clearer outcomes and outputs and report on progress in a more quantitative fashion (and qualitative, for that matter). However, PART heard from multiple individuals that either provide capital, leverage work by capital-receiving organizations, or interestingly, from funding recipients themselves, that a stronger stance should be taken on asking for data for each proposal made, and for data metrics as a necessary outcome of all relevant projects.

In particular, Pittsburgh is extraordinarily blessed with a philanthropic community composed largely of family foundations that is almost second to none across the world. An excellent opportunity which seems widely untapped is the critical role that the foundation community can play in the collection of key regional data points from its cross-cutting and varied projects (most importantly, in a longitudinal design).

With certain data captures in place, the foundation community would then be able to funnel precious data to specialized organizations which can organize, clean, label, and publish the data. Presently, as reported by a local data scientist, "the local funders are in a strong position to incentivize entities to make data available. This would generate wide-spread information for many to help in collaborative fashion, and not strictly rely on cultivating relationships for years to get special access, or always be forced to swap in-kind favors."

This would provide the region with amazing insight into where success is being made and what additional problems need help. And furthermore, it will better inform the foundation community on how to tackle opportunities more efficiently in joint fashion.

Recommendation 2:

Invest in our data infrastructure to create new assets and increase the reliability of data that is made available.

Similar to Recommendation 1 herein, great strides have been made recently at the local and regional level on updating technology components and attempts at data warehousing, especially in the public sector at the City of Pittsburgh's Office of Innovation and Performance (I&P). Using mobile applications (apps) for citizen-reporting on potholes, snow plow movements, and other civic needs has been widely welcomed.

Of course, with any technology infrastructure endeavor, more and more investment will always be necessary to keep up with the latest trends and capabilities, but Pittsburgh should first ambitiously strive to come up to a baseline with its digitization advancements so that data is more readily available. Continued technology interfaces with the general public, with other computer systems in the city, and eliminating paper as quickly as possible will provide more opportunity for accurate and timely decision-making.

Recommendation 3:

Create a regional data officer in charge of a new regional data agenda to promote public and private agencies seeing data as an asset and building more roles around data procurement, cleaning, and management.

The COVID pandemic wreaked havoc on Pittsburgh (and other cities') operating budgets, which will have crippling and rippling effects for several years to come. Early on in this project study participants suggested a centralized human resource dedicated to data--and even technology more broadly for city-wide consultation--would have almost immeasurable positive benefits on equipping all sectors with knowledge to further their endeavors. This is actually now more important than ever before.

PART recommends as a method to break down current data silos, and generate new capability levels, a "Chief Data Officer" to help build and coordinate a "Regional Data Agenda." Study participants noted that data tends to be an organizational asset; but what if Pittsburgh worked together to think about what type of data that data officers can contribute to across different organizations? For example, at the local and regional level in the public sector; schools; healthcare agencies; economic development agencies; etc. A vitally important marker for a modern economy is how data collection and analysis are directly connected to both policy formation and regional initiatives.

If this pathway is broken, bumpy, non-linear, or non-existent, then trust and reliability issues will form. Moreover, a cleavage will form between policy makers and policy practitioners.

Unfortunately, Pittsburgh does not have clean, reliable, publicly available--and as one extremely well-respected and ubiquitous engineer described "hyper-accurate" --datasets for widespread access and analysis. Moreover, limited knowledge existed amongst study participants (who again, covered all sectors) on a current asset map of what data already exists in the region.

Recommendation 4:

Figure out what companies are doing with data they collect and build forums that promote data sharing and support asset mapping.

"I'd like an independent organization, like PART, to be asking local companies and organizations: 'what exactly are you doing with your data, and who is regulating that?'"

Despite this local tech company founder's wish for PART's particular role in the region, and despite the notion that data is usually proprietary (especially in the private sector), data is a lens from which many entities can look through from both a regional strategy and economic growth perspective. Referencing the OECD again and its important growing body of literature "New Sources of Growth: Knowledge-Based Capital" it's becoming more widely accepted that "data-driven innovation forms a key pillar in 21st Century sources of growth." (20)

Cross-sector data portals, forums, and asset maps do not exist for this region in truly robust fashion, and jumpstarting efforts here would have omnipresent gains. Related to this, data privacy and governance will be important and should also be assessed, as it has already been--and certainly will continue to be--one of the hot technology topics for the 2020s.

Recommendation 5:

Involve the community in the creation and curation of new datasets.

Data is the best way to get people involved in the technology sector. Beyond its capability to help promote growth and create jobs, data can be used to tell stories and used to change lives.

As part of the aforementioned "Regional Data Agenda", PART also allowed study participants' personal stories to resonate on how the Pittsburgh region could better start aggregating and organizing data regarding local neighborhoods and communities to drive better information around indicators for quality of life and developing real relationships with citizens.

Along these very lines, Carnegie Mellon University Mathematical Sciences professor Po-Shen Loh, who is also an entrepreneur and has served as the Academic Director of the United States Mathematical Olympiad Program astutely described "we need people in the region to relish the fact that we can be the first in the world to test deep tech and generate good data. Like being proud of the Steelers – we should be proud of creating deep technology here. Let's create relationships amongst our people – don't tell them it's perfect, tell them it's groundbreaking."

20. OECD. "Data-driven innovation for growth and well-being." https://www.oecd.org/sti/ieconomy/data-driven-innovation.htm

SECTION 4:
REPORT CONCLUSIONS

Pittsburgh and its surrounding region have historically generated—and continue to presently maintain—several competitive advantages relative to other domestic and international markets vis-a-vis an innovation and emerging-technology ecosystem.

It's without debate, and has been described in several forums before, that its world-class colleges and universities; avant-garde private technology companies (especially working at the forefront of artificial intelligence, machine learning, deep thinking, and robotics); generous and visionary nonprofit and philanthropic community; and universal shared work ethic put Pittsburgh not only atop of several categories and rankings, but has increasingly given it more attention, time, and space in national discourse. Furthermore, these "feathers in its cap" also position Pittsburgh to further capitalize on opportunities to build a premier economy--one that not only grows in aggregate but can be more inclusive and accessible for all current and future citizens.

But it's clear there is more work to be done.

PART's goal for this research project ultimately became to assess the "connectivity" and "density" of our innovation and emerging-technology ecosystem; to look at how and where collaboration (both internally, and perhaps with external partnerships) could be harnessed more effectively; and explore how to better provide regional decision-makers with the necessary tools to better navigate the challenges and opportunities of today and tomorrow. Through research, and interviewing and surveying 200 individuals across all sectors, varying industries, diverse backgrounds, and levels of corporate seniority and community influence, we strove to attack some of the following questions:

- In the connective tissue that binds our innovation and emerging-technology ecosystem, where are the clear--and hidden--fissures?
- Where throughout our ecosystem is duplicative work being done? Where are there gaps and opportunities; and is that because no one is doing the work; the work can be better; or everyone thinks someone else is doing the work?
- How can Pittsburgh more efficiently and effectively move ideas, people, and capital into and throughout the ecosystem to ultimately tighten up our economic density?
- On what paths does friction (albeit historical, personal, political, organizational, economic, etc.) exist, thus creating roadblocks or delays?
- What data is relevant for us as a region to gather and analyze to help build an economy for the future?
- Realistically, what problems can Pittsburgh tackle with existing resources, while simultaneously, where can external parties help out (individually, or for example in the form of a regional partnership with other cities like Boston and Montreal in the discussed "AI Triangle")?

These and many more questions were relevant to extend beyond a checklist of "what does Pittsburgh have and not have" and also quite necessary to get to the root cause of how we further grow in some areas, and in parallel, how to stimulate areas with shrinking or nonexistent growth in others, and make our region attractive to the outside world for advanced development help (for example, as offered up in the recent Endless Frontiers Act, which seeks to allocate billions of dollars across a few select tech and innovation hubs across the United States).

Consider a cooking metaphor: Any city or regional market may check most or all of the boxes on an "ingredient" list to construct a "recipe" for success for a robust economy. Yet if certain ingredients are expired, insufficient in quantity, added at the wrong time, not prepped ahead of time, or imitation when brand-name is better, something will go awry in execution or outcome. Additionally, if the stove temperature is incorrect (assuming it is working at all), the proper dish or utensils are unavailable, dinner guests were uninvited (by choice or accident), allergies were not surveyed in advance, or the chef has never made the dish before, challenges may also arise.

Put more simply, the timing, blend, quantity, quality, externalities, and basic human skill sets truly matter.

PART identified in this report five macro themes where Pittsburgh's innovation and emerging-technology economy need to focus: capital, leadership, talent and education, strategy, and data, and across these themes, PART humbly suggests 33 recommendations for action and investment. Of course, some of these topics are hardly new--or unique--to Pittsburgh; but as we described at the outset of this study, this work is meant to bind or fill-in, and never before has a topic been probed in this manner. PART prides itself on independence, objectivity, and providing a "safe-space" for individuals and entities to contribute. As a city official described "you are answering many unheard prayers."

In PART's estimation, if regional leadership can collaboratively and responsibility act to cultivate capital channels appropriate for an innovation economy; create intentional and inclusive cross-generational and cross-cultural leadership development programs; invest in broad technology education and expand workforce development programming to boost talent; create a well-communicated regional and national innovation and technology economy strategy; and establish clear and transparent metrics for generating, collecting, sharing, maintaining, and archiving data, then the nodes throughout our collective ecosystem will be better connected, and the foundation upon which our economy is built will become more dense, putting Pittsburgh on an upward path to successfully build an premier innovation and emerging-technology economy.

PART recognizes its suggestions may not be comprehensive and are at the mercy of the study participants' position and potential bias.

Nevertheless, these pages are what regional leaders want and speak. To tackle these and other endeavors will require investment, creativity, partnerships, collaboration, strategy, communication, risk-taking, and in the end, hard work.

But come on Pittsburgh, that's what you do.

ACKNOWLEDGEMENTS

Technological advances challenge many of our shared values, such as equity, fairness, privacy, security, respect, and accountability. Our belief is that experts and stakeholders must work together to ensure that we usher technology in the right direction for the benefit of the many.

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