

Inclusivity, Technology, and Pittsburgh's Quest to be the “Most Livable City In America”

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Project Background

The City of Pittsburgh's recently released "Inclusive Innovation Roadmap" lays out a plan to focus economic revitalization efforts around technology-related growth and upgrade governmental systems to use web-based solutions. Initiated by Mayor Bill Peduto and drafted under the auspices of his newly formed Department of Innovation and Performance (DI&P), The Roadmap was launch in Fall of 2015 with substantial fanfare. DI&P coordinated an "Inclusive Innovation Week" in April of 2016 which grouped dozens of mostly discrete events and gatherings together under the banner of fostering positive changes in Pittsburgh for all sub-sectors of the city.¹

While embodied in a single 36-page PDF document and a javascript-enabled website, its creation involved consultation and planning with a cross-section of organizations in Pittsburgh, including city and county government agencies, private businesses, universities, nonprofit organizations, and volunteer groups. The DI&P details that Roadmap consultation meetings were attended by a total of 102 individuals representing 84 distinct institutions. The meetings gave birth to a set of six focus areas, four of which (shown in bold below) embody the city's desire to implement technology related projects to benefit citizens:

- 1. Address the digital divide**
- 2. Empower City-to-citizen engagement**
- 3. Provide Open Data to Pittsburgh**
4. Improve internal operations & capacity of the City ...
- 5. Advance the Clean Tech sector**
6. Promote the local business environment

The Roadmap emerges during a time of heightened awareness among citizens from across racial and socioeconomic lines concerning the depths of hardship experienced by an unsettling fraction of Pittsburgh residents.² Indeed, a brief scan of alternative and mainstream news sources reveals that many communities

1 The Roadmap's launch received a great deal of media coverage, such as this Post-Gazette article by Robert Zullo accessed via <http://www.post-gazette.com/local/2015/09/09/Pittsburgh-launches-inclusive-innovation-roadmap/stories/201509090127>. The city's Inclusive Innovation week's website contains a calendar of events tied together under the banner of inclusivity across the city: <http://pittsburghpa.gov/innovation-performance/innovationroadmap/piiiv-archive.html>.

2 The New People is an alternative publication created by the local Thomas Merton Center, which is a justice-oriented leftist umbrella group. This article describing the recent joint strike day on April 14, 2016 highlights the degree of wage hardship

within the city continue to struggle immensely to satisfy basic human needs in the wake of the region's near total de-industrialization of the late twentieth century.³

Mayor Bill Peduto, the driving force behind the creation and now implementation of the plan, reflected on the planning team's awareness of the uneven patterns of prosperity and hardship in Pittsburgh:

Too few cities directly address the goal of innovation through the lens of inclusivity. Our decision to be one of those cities will make the Pittsburgh Roadmap for Inclusive Innovation a tool that will not only better the City, but also its community...We must work together with our local stakeholders to diversify our economy and workforce. It is our goal to lay out a vision for not only what city government can and will achieve, but to ensure that we provide these same opportunities to each of our residents through inclusive innovation.⁴

The Roadmap's appendix details the plan's methodology and offers a SWOT (strengths, weaknesses, opportunities, and threats) analysis of the overall endeavor. The commentary on the SWOT chart offers a more direct articulation of the aim of inclusivity which as guiding the Roadmap creation process from its inception:

The toughest factor facing communities in the 21st century is ensuring that innovation and technology have an impact on everyone, regardless of age, race or background. Though the income gap continues to grow nationally, addressing this trend falls upon local municipalities. Pittsburgh aims to be the first city to directly address these concerns through its Roadmap for Inclusive Innovation.⁵

experienced by many residents in the city. <http://newpeoplenews.wix.com/newpeoplenews#!Day-of-Action-for-a-Livable-Pittsburgh/cmbz/57055d8d0cf2ecf50ee6496d>. A scan of the publication reveals the multi-dimensional degree of struggle that many face in the city.

- 3 This article by Professor Joel Tarr published in the Post-Gazette in 1998 lays out the basic historical points in Pittsburgh's industrial past and highlights the degree to which a neighborhood such as Hazelwood, PA, is still struggling to recover from the abandonment of Pittsburgh by major industrial behemoths who pursued a strategy of off-shoring and internationalization beginning in earnest in the 1980's. <http://old.post-gazette.com/forum/19980527btarr4.asp>.
- 4 Pittsburgh's Roadmap for Inclusive Innovation. 2015. Accessed via <http://pittsburghpa.gov/innovation-performance/innovationroadmap/documents/Pittsburgh-Roadmap-for-Inclusive-Innovation.pdf>. I'll refer to this document as "The Roadmap" throughout the document.
- 5 The Roadmap, page 33.

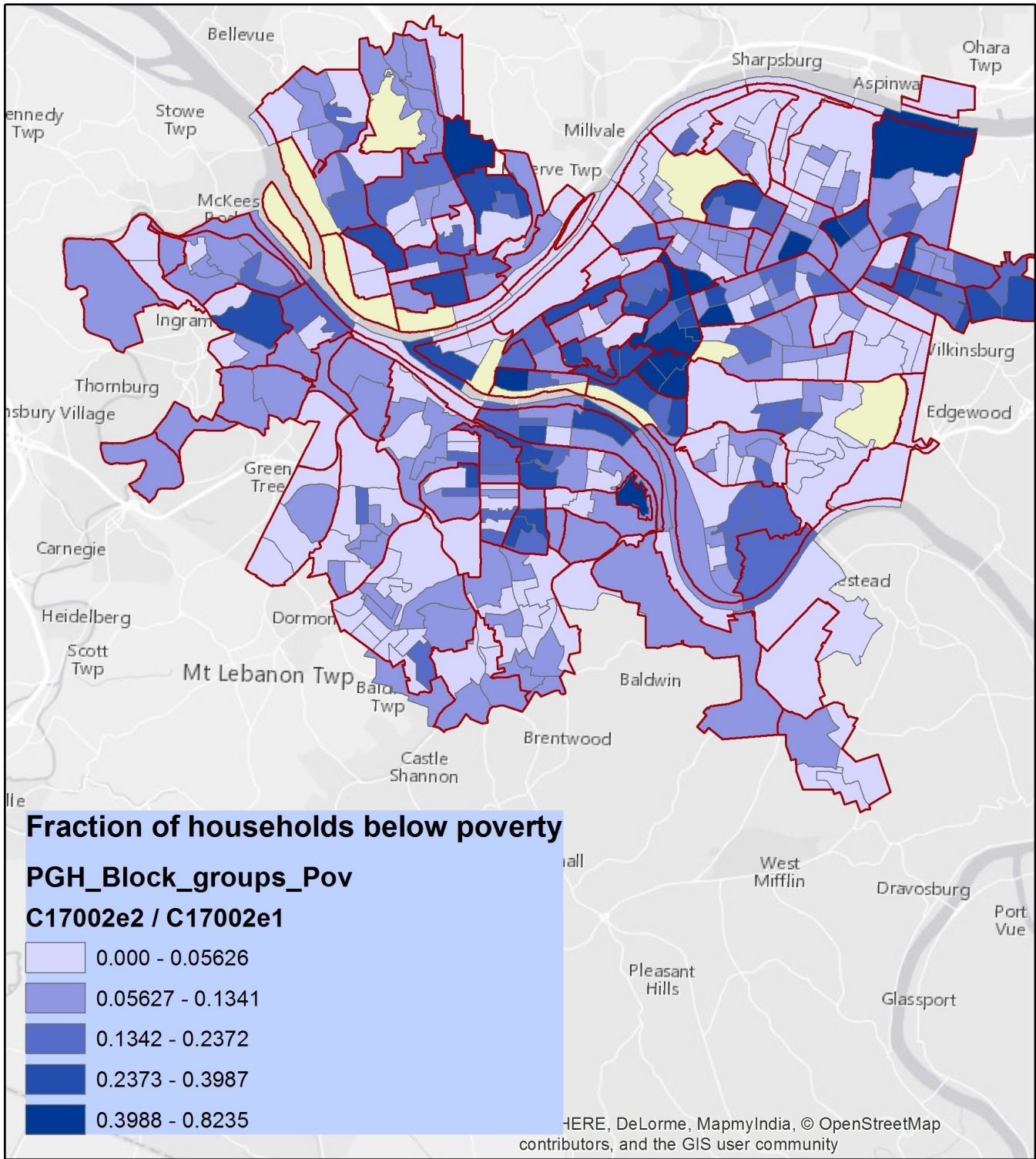


Figure 1: Poverty in Pittsburgh

The map contained in Figure 1 emphasizes *the* degree to which the cited statements above concerning the intent behind the Roadmap do indeed reflect the reality of life for many in Pittsburgh. The image is a single

layer choropleth map depicting the fraction of families in each census block group who reported an income over the past 12 months that is below the federal poverty threshold (taking into account household size).⁶ With some census block groups determined to contain poverty levels measured at upwards of 75% of all families, The Roadmap's aim to promote *inclusive* growth is a worthy—and indeed extremely urgent—goal for the City of Pittsburgh to pursue.⁷

Two city agencies are charged with implementing The Roadmap: Pittsburgh's Department of Innovation and Performance (I&P) and the Urban Redevelopment Authority of Pittsburgh (URA). Their efforts occur during a period of financial distress and severe resource limitations within the city's budget. As of 2004, in fact, Pittsburgh has been operating under “Act 47 oversight,” a name which references the technical title of the Municipalities Financial Recovery Act. Due to consistent shortfalls in city tax revenue and a chronic under-funding of post-employment benefit funds, the Act 47 oversight process seeks to provide technical assistance and monitoring from the State of Pennsylvania as Pittsburgh struggles to calibrate its revenue and expense streams to create a decent likelihood of long-term solvency.⁸

City staff acknowledge the limitations that the City's solvency crisis imposes on The Roadmap's potential for success. Language in The Roadmap's appendix offers a refreshingly frank—albeit gloomy—reflection of these limitations: “The organizational capacity of the City is one of its biggest handicaps across each of the identified sectors [in the Roadmap]. Without fully staffed departments equipped with trained personnel who have a clear understanding of the new methods, systems, and structures, many of the initiatives set out in this Roadmap may be unattainable.”⁹

Given the uncertainty regarding The Roadmap's likelihood of driving substantive changes in the lives of Pittsburgh's residents due to financial hardship at the city level, a healthy amount of creative thinking—innovation perhaps—will be required to carry out such a bold initiative during a period of administrative restriction. Debra Lam, the director of the I&P department, aptly describe the Roadmap as a “living document”¹⁰ which would seem to both emphasize the flexibility she sees in the implementation process but also the risks associated with keeping a living creature alive and well: living documents, by definition,

6 Gathered by the US Federal Government through its American Community Survey (ACS) program, the data are generally regarded as a statistically relevant set of metrics regarding overall community health and functioning.

7 The ACS data can be downloaded freely by the public via <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>.

8 The most recent Act 47 recovery plan update is published by the city and can be accessed via http://apps.pittsburghpa.gov/cbo/Act_47_submitted_2014_plan_5_30_14.pdf. The document contains an executive summary that clearly lays out the terms of the recovery process and the City's plan for addressing budget shortfalls.

9 The Roadmap, page 33.

10 Interview with Lam referenced in Zullo's Post-Gazette article, reprinted at govtech.com, accessed via <http://www.govtech.com/dc/articles/Pittsburgh-Mayor-Details-Citys-Inclusive-Innovation-Road-Map.html>.

can also die without proper nurturing and care.

To aid in preserving The Roadmap's life, this policy analysis will seek to provide insight into the degree to which the plan embodies its stated goals and, based on those findings, offer suggestions for implementing the plan within a context of severe resource constraints. To guide this process, two questions were extracted from The Roadmap document, with special attention paid to the written account of concerns expressed by participants in the Roadmap's "Innovation Roundtable Series":

1. How does the civic tech market in Pittsburgh operate? To what degree Is the *civic tech market* in Pittsburgh a meaningful dimension of analysis for investigating The Roadmap's intention of creating inclusive growth in the City?

2. Given Pittsburgh's financial distress, what concrete, resource-maximizing suggestions can a market-oriented frame of analysis of the civic tech market offer the department of I&P as it decides which Roadmap projects to prioritize?

These questions form the high-level structure of this analysis. I will first begin by investigating the nature of the "civic tech" market in order to provided a theoretical foundation for making suggestions for how the city can impact—or more strategically—can manipulate the market forces at work to accomplish the Roadmap's aims. A detailed examination of how open source technologies, city "data" subsidies, and strategic partnerships can be used within the civic tech market to further the aim of inclusive growth will be offered in part 2.

1. Structure and dynamics of the "Civic tech" market

The Roadmap is a planning document, not an academic text. As such, it does not state explicitly the conceptual models on which its focus areas and action steps rest. To provide the city with meaningful suggestions for implementing The Roadmap, I will draw on a number of theoretical constructs to guide and ground the suggestions that I offer.

One core framework is the market analysis. Market-mediated relationships form the backbone of American society, and, indeed, the entirety of today's globalized economy. Diverse consumers groups, government entities, and, of course, for-profit firms constitute the core actors in the traditional model of how scarce resources are allocated in a market oriented system. Since markets are multifaceted, inter-related entities, a systematic examination of how they work necessarily requires slicing the larger market down into smaller

bits, often called segments, sectors, sub-sectors, or fields. The process of sector-based analysis can then proceed with clear bounds around the entities functioning within the chosen field. Boundedness therefore provides the vehicle for making sense of the amorphous, often undefined nature of a new area of research such as the civic tech field.

After background reading and experiencing working with nonprofits in the Pittsburgh area, the new sub-field known as “civic tech” does seem to encapsulate the bulk of the entities and their manifold interactions that implementing that the DI&P. Our first mental model of how civic tech functions is displayed in figure 2.

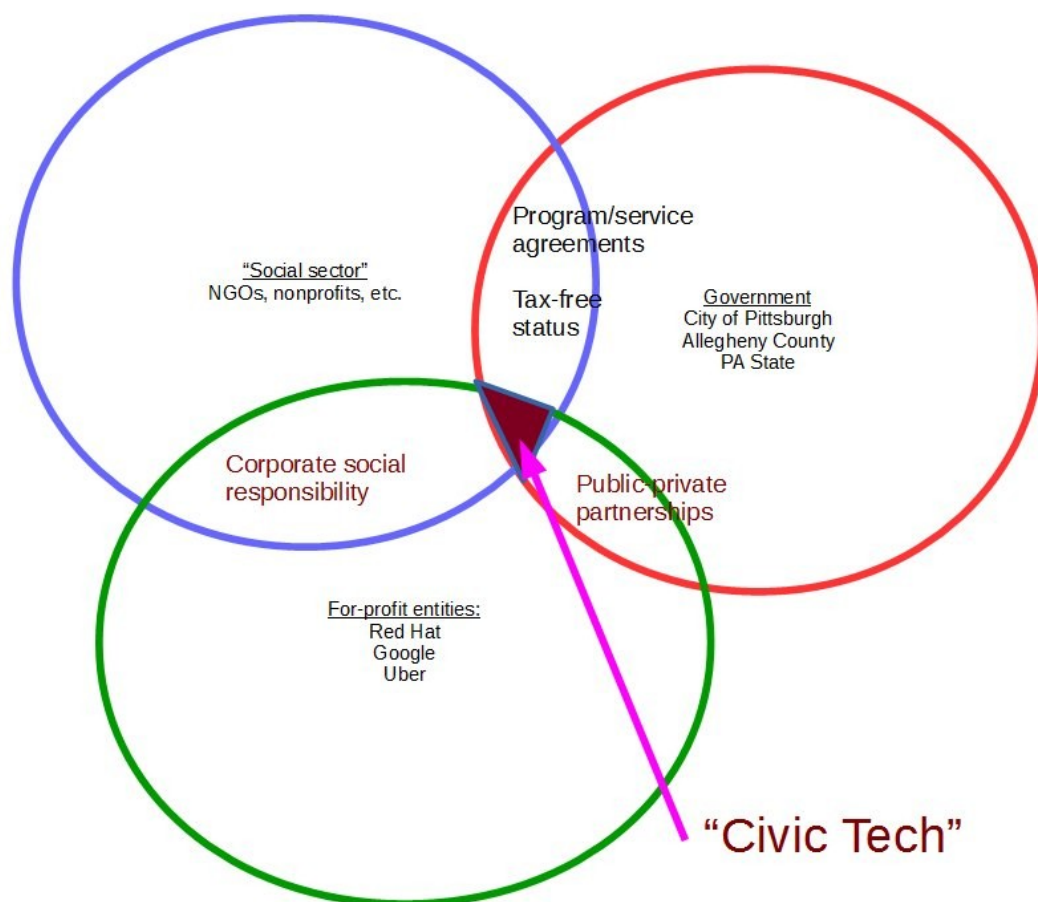


Figure 2: Preliminary model of the civic tech sphere as the intersection of three larger institutional spheres

This section will open by examining the legitimacy of and challenges with using a market framework for analyzing The Roadmap. With *civic tech* established as our field of focus, I will then explore what the sector consists of, its main actors, and touch briefly on the unusual interactions between them. I will close the discussion of the civic tech field as an entity by using Clayton Christensen's theory of disruptive technology

to speculate on how its recent emergence interacts with other segments of the larger market biosphere.

Exploration of the market-based frame of analysis

The Roadmap's overall structure is designed with business-driven growth at its core which is, of course, a goal rooted in the existence of a market in which goods and services are produced, exchanged, and regulated. In fact, the sixth and, arguably, most important focus area of The Roadmap is stated in plain terms: to “promote the local business environment.” The project aims listed under this focus area seek to cultivate a policy and economic environment in which for-profit entities can thrive by carrying out programs such things as “supporting mentorship and fellowship programs,” “support local business in Pittsburgh,” and to “connect local businesses with capital and resources.”¹¹

Additionally, the Roadmap's fifth focus area, “advance the clean tech sector,” focuses city resources on a particular sub-sector of the local economy. Digging into this focus area, one finds a description of a project aim to “increase awareness and demand for clean technology.” The Roadmap justifies this project aim by asserting that developments in the clean technology sector has led to a 29% increase in employment from 2003 to 2010. In the same section, The Roadmap also notes that while new jobs have been created, the growth of Pittsburgh's clean tech sector has not kept pace with other benchmark cities.¹² This focus area firmly establishes the city's intent to use job creation through market means as its vehicle for societal improvement. With market-based thinking clearly underpinning The Roadmap's goals for improving life in Pittsburgh, this section explores the degree to which this frame of reference (and its applicable analysis techniques) is justified for realizing these bold humanitarian goals.

While folks in Pittsburgh clearly would benefit from more widespread access to well-paying jobs, the causal link between market-driven job creation and generalized community well being is certainly not guaranteed. While market-based growth models seem to dominate the public policy and urban development literature,¹³ many non-capitalistic institutions and schools of thought exist which contend that this model may not, in fact, elicit the positive outcomes proponents of market-thinking claim. Being cognizant of the core thrust of such counter-proposals will provide context for the market-based tools which will be used throughout this analysis.

11 The sixth focus area and its sub-projects are described in pages 24-28 of The Roadmap.

12 The Roadmap, page 24.

13 Within this vast field, one might start with publications by the US governments department of Housing and Urban Development. Their economic revitalization projects emphasize the market-oriented approach it trains cities on using to promote community well-being. See <https://www.hudexchange.info/community-development/project-profiles/> for the profiles.

Arguments against market-based thinking exist along a spectrum: on the far left, anti-capitalists advocate abolishing the entire structure under which for-profit entities function today. Socialists—considered as a broad grouping of philosophies rooted in the writing of Marx, Engels, Lenin, Luxemburg, and others—articulate a program to replace capitalist institutions with worker-led democratic structures in which capital is controlled by workers themselves and not a separate layer of capital owners who then attempt to maximize profit by capturing the excess value created from labor and capital inputs to the production process.

The International Socialist Organization (ISO), for example, publishes *The Socialist Worker* and the more academic *International Socialist Review* which together are just one instance of a body of writers and activists who have articulated a well-formed set of positions to counter the market-based ideologies. They seek to respond to the urban policy space which privileges capitalistic thinking—a sphere in which The Roadmap is firmly lodged—and advocates a host of market-aligned initiatives such as injecting financial pay incentives in the public sector as well as the pervasive desire for formulating public-private partnerships to accomplish civic aims. Such policy mechanisms are neither guaranteed to benefit the target population subgroup of The Roadmap. For example, Socialist Worker writer Leela Yellestey documents the insidious ways in which the tech “boom” in Seattle has ushered in a material degradation in the quality of life for many city residents who can no longer afford to live in their homes due to increased housing prices.¹⁴

Yellestey calls for greater state intervention in the short term to insure affordable housing for *every single citizen* and, in the long-term, complete worker control over the business decisions of major social enterprises. While often dismissed as impractical or, worse, *dangerous revolutionary thinking*, the socialist position is rooted in evidence and experience accumulated over multiple centuries of careful thought and experimentation by far-left groups worldwide. Their ideas may lie outside the mainstream course of political dialog in Pittsburgh but the dismissal of these ideas by dominant players in the urban planning decision sphere should not be interpreted *ipso facto* as evidence against their potential for fomenting the betterment of the broader society.

A step away from the more radical position of socialist organizations like the ISO are progressive economic think tanks such as the Center for Economic Policy and Research (CEPR) based in Washington, DC. Founded by economist Dean Baker, the CEPR regularly publishes papers, blog posts, news analyses, and seminars

14 Yellestey, Leela. Feb 24, 2016. The Socialist Worker. Accessed via <https://socialistworker.org/2016/02/24/the-secret-hidden-behind-seattles-boom>.

which draw attention to the ways in which current market-driven growth effectively locks many citizens at the bottom of the market system into a life of insecurity, uncertainty, and hardship. One such example is a CEPR briefing titled “Finding the time: Challenges facing working families.” The report draws attention to the ways in which even a country like the USA with its so-called advanced market structures still fails to provide even a basic assurances of security to residents who are, in fact, employed at or above full time levels.¹⁵ While Baker and his staff do not call for a worker revolution against privatized capital, the CEPR routinely calls into question state policy paradigms which center the for-profit institution as the core vehicle of community growth.

Both of these examples of alternatives to capitalist market-based thinking highlight the need for the City's Department of Innovation and Performance to carefully consider the limitations of the market-based approach to improving the lives of Pittsburgh residents. Framing *innovative growth* as the core aim of a policy set to improve the lives of residents inclusively is not, as this section as asserted, the only or necessarily most effective way to accomplish The Roadmap's aims.

Yet, given The Roadmap's clear market-based betterment model, I shall proceed to investigate the civic tech sector as the core unit of analysis for the remainder of the report. To do so, I will address the extent to which civic tech sector can be thought of as functioning like a “normal” market segment and explore the ways it appears to deviate from traditional models. This will lay the groundwork for section 2: Suggestions for harnessing the characteristics of the civic tech market to foster inclusive growth.

Defining the structure of the civic tech market

By segmenting and naming components of a larger markets one can define a set of bounds around the entities of interest. By doing so, relationships between those entities can then be modeled and structured. Components *within* a given boundary can be thought of as displaying certain types of interactions that can be contrasted with flows across a segment boundary, for example. A number of tools developed for conducting market analysis do so by creating and manipulating abstractions of the *real world* to isolate an effect or pattern of interest. Some models use simple lines and figures drawn on paper (or perhaps, more technically, a two-dimensional drawing plane) while other tools create mathematical representations of a network of nodes and their edges, each of which can be imbued with parameters and values, all of which are stored inside a computer, ripe for processing.

15 See the powerpoint side deck associated with this set of research findings on the CEPR website, www.cepr.net and specifically via <http://cepr.net/publications/cepr-briefing-series/cepr-work-a-family-briefings>.

Such abstractions, while analytically useful for reducing complexity and isolating entities of interest, are also, by definition, reductionist; by focusing on a limited subset of forces at work, other potentially critical dimensions of the segment of interest are stripped away. When a complex model has been developed, removing components makes sense to focus one's thinking systematically. But if the original market model is incomplete or flawed, the conclusions it suggests will preserve those initial shortcomings and weaken the model's usefulness. For this reason, the remainder of this section will attempt to build on existing conceptualizations of the *civic tech* market in order to create a model of the civic tech field in Pittsburgh specifically. We will attempt to formulate a model that is complete enough support the recommendations offered to the DI&P in section 2 and, most importantly, *useful enough* to aid in the day-to-day struggle against racial and economic injustice in Pittsburgh.

Figure 1 presented an initial framework for placing the civic tech market among the three well-known institutional dimensions of society: government, private business, and the so-called *third sector* which is home to nonprofits and voluntary organizations. It uses the concept of overlapping sets to depict civic tech as a set of relationships that reflects characteristics of each of its intersecting “spheres.” Each of these larger spheres should be understood to include an entire sub-ecosystem of people, institutions, policies, incentives, each changing through time.

This model is useful, in part, because it defines this new, unfamiliar, market segment in terms of concepts which which readers are no-doubt already familiar. Civic tech, for example, overlaps with the governmental sphere because its actors are generally concerned with same broad notion of community health and well-being as are public agencies such as local and state governments. Overlap with the private sector is appropriate because profit-motivated companies play an integral role in developing and disseminating new technologies—such as handheld computers (i.e. “smart” phones)—which become platforms and services leveraged by players in the civic tech sub-sphere. Finally, civic tech resembles attributes of the nonprofit sphere because many civic tech firms are often administratively classified as tax-exempt, nonprofit organizations with boards of directors rather than customers. Nonprofit civic tech firms have missions which diverge from profit-motivated entities and instead attempt to enable, facilitate, or create products and services that meet needs unmet by the market system.

The preliminary model also attempts to classify the overlapping space between two of the three major spheres as a point of relation between civic tech and other broader trends in the institutions that make up society. The intersection of government and private business, for example, is labeled “public-private

partnerships” to suggest that civic tech is *not just* a government and a business working together to, say, bring an app-based parking meter service into operation. Such an interaction is, indeed, cross-sectoral in nature but excludes to a large degree the important “civic” component of civic tech in which the concerns and livelihoods of the broader members of society are directly addressed by the entity in question. A city or nonprofit using technology solutions to reduce operating costs does, for example, does not automatically land that entity in the civic tech sphere.

By thinking about how civic tech pulls elements from each sphere, a few more classification examples are instructive. For example, a civic tech firm called NationBuilder which offers a Salesforce-like platform for political campaigns and activist groups is a self-identified leader in the new field. It's founder, Jim Gilliam, proclaims with conviction his intent to use technology to accomplish civic good.¹⁶ So NationBuilder, although a for-profit entity, seems to fit comfortably within civic tech since it serves a largely nonprofit client base and seeks to blend a flexible, creative culture with an intent to foment positive social change across sectors and issues. Alternatively, a government agency, such as the Allegheny County Planning Department, falls outside the civic tech market even if it has released a trove of data using a public-facing, easy-to-access geographic information system.¹⁷

Edge cases reveal the simple model's weaknesses. The #BlackLivesMatter movement is one such ambiguously located entity that displays some characteristics of the prototypical civic tech entity but does not fit neatly into any of the model's compartment. What is now referred to as the BlackLivesMatter *social movement* was founded by Patrisse Cullors, Opal Tometi, and Alicia Garza using the Twitter hashtag #blacklivesmatter in response to the murder of Trayvon Martin in 2012 and the subsequent acquittal of his assassin, George Zimmerman. Blacklivesmatter.com, the official website of the movement, describes itself as “an ideological and political intervention in a world where Black lives are systematically and intentionally targeted for demise. It is an affirmation of Black folks' contributions to this society, our humanity, and our resilience in the face of deadly oppression.”¹⁸

The group displays several of the overlapping characteristics of a civic tech entity that the model suggests: the group's primary organizing mechanism has been internet-enabled social media and their mission

16 Jim Gilliam's website <http://www.jimgilliam.com/> details many of his writings on the subject of technology and social good. He has delivered a well-received TED talk titled “The Internet is My Religion” and is accessible via <https://www.youtube.com/watch?v=-4WKle-GQwk>.

17 The Planning Department for Allegheny county feed data into a GIS viewer accessible via <http://webmaps.alleghenycounty.us/acgisviewer/>.

18 Excerpt from the History page of blacklivesmatter.com accessed via <http://blacklivesmatter.com/herstory/>.

obviously concerns improvements to our collective civic space. Further, their work concerns issues of justice and citizen-government interaction, which reflects the civic tech market's overlap with the government/public sector. The ambiguity arises because to consider BlackLivesMatter a member of the civic tech market would imply that any other organized group of individuals which coordinates social action via the Web should also be considered part of the civic tech sphere. To do so would expand the members of the civic tech class so broadly as to dilute the analytical value of analyzing civic tech as a market with distinct characteristics from for-profit tech firms, governments, and nonprofits.

Thus this first model has limited utility beyond grounding our discussion of more advanced models by creation eliciting a rough mental picture of which kinds of entities we mean when we say *civic tech*. It fails to present a concrete way to reliably classify which organizations should be considered inside the civic tech market and which ones do not, making a thorough market analysis impossible. To accomplish our core objective—defining the bounds on civic tech as a field such that the interaction between entities can be systematically explored—we will need a more powerful model.

More complex models of the civic tech market

Much like the broader for-profit technology field, lots of money is flowing into organizations loosely classified as civic tech and this flow by itself impacts the market dynamics at play and, as a result, how one can accurately conceptualize the market. An article by Mike Montgomery at Forbes draws attention to the new field precisely for this reason: unlike a decade ago, when investors shunned public sector investment prospects, civic tech firms today represent a potential site for financial investors scouring the country for “the next big thing” to transform their investments into capital gains. According to Montgomery, one core force behind public-sector spending on civic tech products, such as those offered by OpenGov, an online government budget tracking platform, are citizen demands for greater government accountability. As waste in government rises to new consciousness in America, Montgomery claims private tech firms stand to profit financially from governments willing to invest heavily in technology products to facilitate their response to citizen rumblings for greater transparency.¹⁹

Accela, a civic tech firm which like OpenGov, creates citizen-government engagement tools, paid IDC, a market research firm, to investigate magnitude and potential of private investment within the civic tech sphere. The 2014 study—encapsulated in a slick, multi-page infographic—suggests that of the \$25.5 billion

¹⁹ Montgomery, Mike. “Why Civic tech is the next big thing.” Forbes. June 24, 2015. Accessed via <http://www.forbes.com/sites/mikemontgomery/2015/06/24/why-civic-tech-is-the-next-big-thing/#4bc33595e24b>.

that federal, state, and local governments will have spend on information technology overall in 2015, \$6.4 billion (25%) will be channeled into the civic tech sub-sector.²⁰ This relatively recent infusion of private, profit-seeking capital into civic tech firms underscores both the complexity of interactions across the three core spheres of the original model as well as the continually shifting character of the civic tech market as a whole. Venture capital has historically steered clear of the much less predictable realm of citizen engagement and so these recent shifts in capital distribution are as complicating as they are notable for our understanding of civic tech.²¹

Civic tech encompasses more than software to facilitate citizen-government interaction. These tools represent only a slice of the technologies and entities involved in this emergent ecosystem. Civic tech at its highest level can be thought of as a market segment that encompasses a much wider variety of market entities than a traditional market sector, such as, say, steel manufacturing, which has a relatively few and mostly fixed structural relationships between suppliers, customers, shipping companies. While it is the case that traditional market segments involve complicated relationships between governments, intergovernmental agencies (such as the World Trade Organization and bilateral trade agreements), investors, and customers, the unexpected ways in which technology and data impact the civic tech sphere constitutes a unique market conditions and, therefore, demands new models for understanding its behavior.²²

The Knight Foundation's 2012 study of the growth and dynamics within civic tech provides a more nuanced taxonomy of the entities within the market than the original, simpler model. Their oft-cited study²³ categorizes civic tech firms into one of eleven classes which are held by two super-classes: *open government* and *community action*. The 11 categories are listed in Figure 3 with asterisks used to denote

20 The IDC infographic is accessible via <http://www.accela.com/images/civic-tech-infographic-idc.jpg>. GovTech, an umbrella group for government technology, reported on the findings in a post in December 2014, accessible via <http://www.govtech.com/budget-finance/6-9-Billion-to-be-Spent-on-Civic-Tech-in-2015-Report-Says.html>.

21 The massive infusion of financial capital into civic tech entities adds a dimension of complexity to our concept of the civic tech market because of the profound ways in which the quest for profits which accompany venture capitalist attention has potential to confound or displace the sector's focus on promoting widespread improvements in civic health. Unfortunately today, when investment returns are delimited only in dollars, any non-financial objectives of a project can quickly become instrumental to generating financial profit, and, perhaps render the human aims associated with such projects completely irrelevant.

22 This startup kit published by ultralightstartups.com highlights the relatively narrow focus of a traditional market analysis. http://ultralightstartups.com/wp-content/uploads/2012/04/How_to_Prepare_a_Market_Analysis.pdf. The guide focuses the reader on consumer and producer relationships and excludes consideration of how public interest and government interactions lead to unusual and unexpected new entrants such as \$6 billion in venture capital funding appearing over the course of just a few years.

23 The IDC study cites the Knight study (cited below), as well as groups like the Intersector Project which investigates cross-sectoral collaboration of many varieties. Their reference to the Knight study is on their blog post about Knight's use of network mapping: <http://intersector.com/network-mapping-investments-civic-tech/>.

the study's assessment of relative sub-sector size as measured by the number of firms counted through a news analysis. ²⁴

Figure 3: The Knight Foundation's demarcation of the civic tech field by sub-sector, 2012.

Open Government	Community Action
Data access and transparency**	Civic Crowdfunding*
Data utility**	Community organizing***
Public decision making**	Information crowdsourcing**
Resident feedback**	Neighborhood forums**
Visualization and mapping**	Peer-to-peer sharing***
Voting*	
NOTES: *** = large subsector size, ** = medium subsector size , * = small subsector size	

The Knight foundation used these 11 sub-sectors to analyze the amount of private versus public investment in each sub-sector, their respective growth rates, and even their level of connectedness to other sub-segments.²⁵ Using a language parsing algorithm, a connectedness score was generated to depict the strength of ties among the hundred or so civic tech firms selected for their in-depth study. The authors depicted the result of their network model with a sleek visualization in which the nodes in the network represent civic tech firms and the thickness of the arcs connecting them supposedly correspond to the number of cross references found in the news parsing process.²⁶

The Knight model, however, is confounded by a muddled categorization scheme used to classify civic tech

24 Patel, Mayur, et al. "The Emergence of Civic Tech: Investments in a Growing Field." December 2013. The Knight Foundation. Accessed via http://www.knightfoundation.org/media/uploads/publication_pdfs/knight-civic-tech.pdf.

25 Patel, *ibid.* See page 14 for overall growth rates, page 15 for growth by cluster, and the investment data starts on page 16.

26 Interestingly, the thickness of the arcs connecting two nodes described as being proportional to the strength of the connectedness between the two nodes. The connecting arcs, however, are actually an uneven even thickness (see Figure 3), eliciting a sense of ethereal movement—perhaps a provocative, albeit forced, metaphor for just how embryonic and malleable our collective definition of the civic tech field actually is.

firms. For example, *visualization and mapping*, listed as a sub-sector of *open government*, also plays a role *inside* nearly all of the sub-segments under *community action*. Their taxonomy suggests that *mapping and visualization* functions as a sub-sector that is differentiable from other sub-categories in the same way as the more clearly separate categories of *neighborhood forums* and *peer-to-peer sharing*. It may be more realistic to refrain from categorizing civic tech firms themselves from one another and instead focus on mapping the diversity of interactions that each so-called type has with other types of civic tech entities.

A practical example of this potential confusion over what delimits one sub-sector from another illustrates the tension described above: what if one sector uses the tools and technologies of another? Knight classifies an organization called Bang The Table as part of the “community organizing” class. Bang The Table specializes in citizen engagement and yet, in November of 2013, they launched Mapper which is “a simple tool for collecting information with a spatial component.”²⁷ While it is true that Bang The Table does not disclose how much of their own efforts were directed toward developing Mapper, it seems fair to say that a visualization and mapping component is likely to be an integral part to any activism and citizen communication platform. Perhaps rather than including *visualization and mapping* under the *open government* super class, a better model of civic tech groups could involve two axes of categorization: 1) analytical tools of focus and 2) type of citizen interaction sought.

The civic tech market in perspective

We have seen so far that the civic tech sphere is not only characterized by complex interactions between actors from different sectors of society, but also by the ways in which market forces are at work within the sub-sector. This dual complexity has implications for the City of Pittsburgh as it strives to encourage inclusive growth by interacting as a critical player in the civic tech market of Pittsburgh. Figure 5 contains a sketch of ways in which the essentials of market economics are manifest in the traditional for-profit system, the government sector, and the unusual emergent civic tech sector.

²⁷ See the mapper rollout blog post: <http://bangthetable.com/2013/11/08/launching-mapper-our-spatial-engagement-tool/>.

Figure 5: Table depicting differences in market structure between for-profit entities, government, and the more amorphous civic tech sector.

Market fundamental	Traditional for-profit market systems	Government	Civic Tech
Exchange of tangible goods and services through supply and demand	Consumers demand products from suppliers who manufacture or offer services through money-mediated exchanges	Services offered to citizens based on legal requirements and public feedback. Taxation and reallocation revenue model.	“Social capital” is cultivated and nurtured. Information flows alongside money. Demand emerges from social need.
Profit incentives and competition drive impact price and quality	Profit maximization and competitive forces tend to drive prices down and quality up for the average product.	No profit incentive. Quality of service regulated by legal frameworks, voting-based accountability, internal audit, and public opinion.	Hybrid incentives of profit, public accountability, self-interest based improvement, and “do-goodery warm fuzzies”
Intervention through regulation and subsidies changes behavior	State regulates some firm behavior (EPA, antitrust, banking, OSHA) and subsidizes others (US Farm subsidies, tax exempt business relocation incentives)	State itself operates based on laws passed by legislature. Creates subsidy and regulatory policy for other sectors.	State and disparate institutions offer 'data subsidies' to civic tech firms. Information disclosure regulation impacts possible project dimensions.

For each of the market fundamentals listed at the beginning of each row in figure 5, note how the civic tech sphere encompasses both hybrid elements of the other two sectors. Money is used to buy and sell tech products within the civic tech market, and this is not dissimilar from a traditional market for material goods. The table also describes that in addition to money flowing within civic tech, information flows and so-called “social capital” flows through market entities. We can think of social capital as a good which is

produced—or perhaps stated more accurately, facilitated—by all the types of groups working in civic tech.

Social capital is a concept pioneered by sociologist Robert Putnam and has since been adopted by many academics as a valuable analytical construct for modeling how certain connections between individuals translates into tangible and beneficial outcomes for its holders.²⁸ Broadly speaking, social capital can be thought of as webs of person-to-person connections which can be *activated* to solve problems, create new forms of informal organization (i.e. a neighborhood watch), and facilitate connections between individuals across disparate networks.

The classic case of social capital in action is securing a job through “networking” rather than the traditional “cold resume submission” process. By invoking a preexisting, trusting relationship with somebody inside a desired organization in order to secure a position or at least get an interview, the exerciser of social capital has secured some degree of personal benefit and, by extension, well-being. This common practice gives legitimacy to the maxim that *who one knows* is just as important as *what one can do*. The concept of social capital extends this idea to describe the many significant and subtle ways in individuals benefit when their connections to others in neighborhoods, churches, governments, police forces, etc. increase in quantity and intensity.

With this framework in place, connectedness that leads to accumulations of social capital can be nurtured through both unstructured and structured interventions. Simply building a park or garden out of a vacant lot in a neighborhood lacking green space can, all by itself, generate social capital in the community. As residents gather informally in the garden or park, they learn about each others' lives through stories and routine discussion. Putnam's and his colleagues²⁹ have concluded that as social capital increases through these kinds of seemingly inconsequential interactions, folks naturally begin to assist one another in organic ways as problems arise and opportunities for betterment present themselves. The exchange of assistance is rendered under what is termed generalized reciprocity in which an expectation of *returning the favor* exists but is understood to occur at an undefined time in the future. Putnam demonstrates that it is precisely

28 Putnam has written extensively on the subject. His book, *Bowling Alone*, outlines his thoughts on the changes of social structure in the USA since the advent of recent television and electronic technologies. A paper published by the OECD in which Putnam outlines the definition of social capital and discusses how to measure this new creation of academia can be accessed via <http://www.oecd.org/innovation/research/1825848.pdf>. The World Bank also has a social capital assessment tool and guides for using it accessible via <http://documents.worldbank.org/curated/en/2002/06/1942065/understanding-measuring-social-capital-multidisciplinary-tool-practitioners>.

29 So useful is the concept of social capital in understanding social behavior, entire websites have sprung up to assemble the existing literature on the subject. A simple internet search yielded the following interesting resources: <http://www.socialcapitalresearch.com/literature/introduction-social-capital-research.html> is a blog by an interested MS graduate in Canada.

these kinds of relationship-based connections of trust that translate into substantive improvements in the quality of life people on individual, community, and even national levels.

Civic tech, therefore, can be thought of as sector which fosters the accumulation of not of financial—but social—capital among those who engage in its activities. A civic tech nonprofit called Front Porch Forum (FPF) is an exemplar of the social capital generation effects facilitated by technology. Serving residents of Vermont, FPF provides a simple yet powerful platform for people who live in physical proximity to one another to share information about events, crimes, and needs within their communities. A quick scan of their blog provides primary data confirming just how this process unfolds. A poster named Grace from Mad River Valley posted a thank-you to the online community when after she received help moving. She writes: “Thank you everyone for your interest in helping me with my moving/unpacking project. I found someone in 10 minutes after posting! I thought I would get zero replies! Front Porch Forum is amazing.”³⁰

In Grace's case, she exercised her social capital—generated by Front Porch Forum in the form of digital connections between neighbors—to assemble *people* resources to help her move. Doing so certainly freed up financial resources that might have otherwise been channeled to a for-profit moving company without ties to Grace's specific neighborhood (and therefore less likely to generate additional social capital). Far more importantly, however, during the moving process itself additional social capital was created as the neighbors who volunteered to help Grace move strengthened their connections and trust with one another. The recursive (i.e. “snowball”) effect of these connection-enhancing activities means that if another—perhaps more pressing—matter arises in the future, those residents who gathered to help Grace move will be increasingly willing and comfortable collaborating to solve the new issue, whatever it may be. The added security, interpersonal satisfaction, and community cohesion that flows out of such social capital garnering events is, no doubt, a dimension of growth and community health that the City of Pittsburgh would be wise to encourage as much as possible when implementing the Roadmap.

Pittsburgh's civic tech network schematic

The value of a market analysis lies in the ability to use a robust model of the market's actors and their interactions to accomplish a tangible outcome—in our case, inclusive growth through technological innovation in Pittsburgh. Having examined several frameworks for describing the civic tech market generally, we are now in place to formulate a network schematic of the core entities comprising

³⁰ The Front Porch Forum Blog is accessible via <http://blog.frontporchforum.com/> and contains other examples of social capital in action, such as finding lost pets, sharing crime incident details, raising funds for local businesses, and much more.

Pittsburgh's own civic tech market. Figure 6 depicts a dozen or so entities which interact with the City of Pittsburgh's DI&P and the URA--two departments tasked with implementing The Roadmap for Inclusive Innovation.

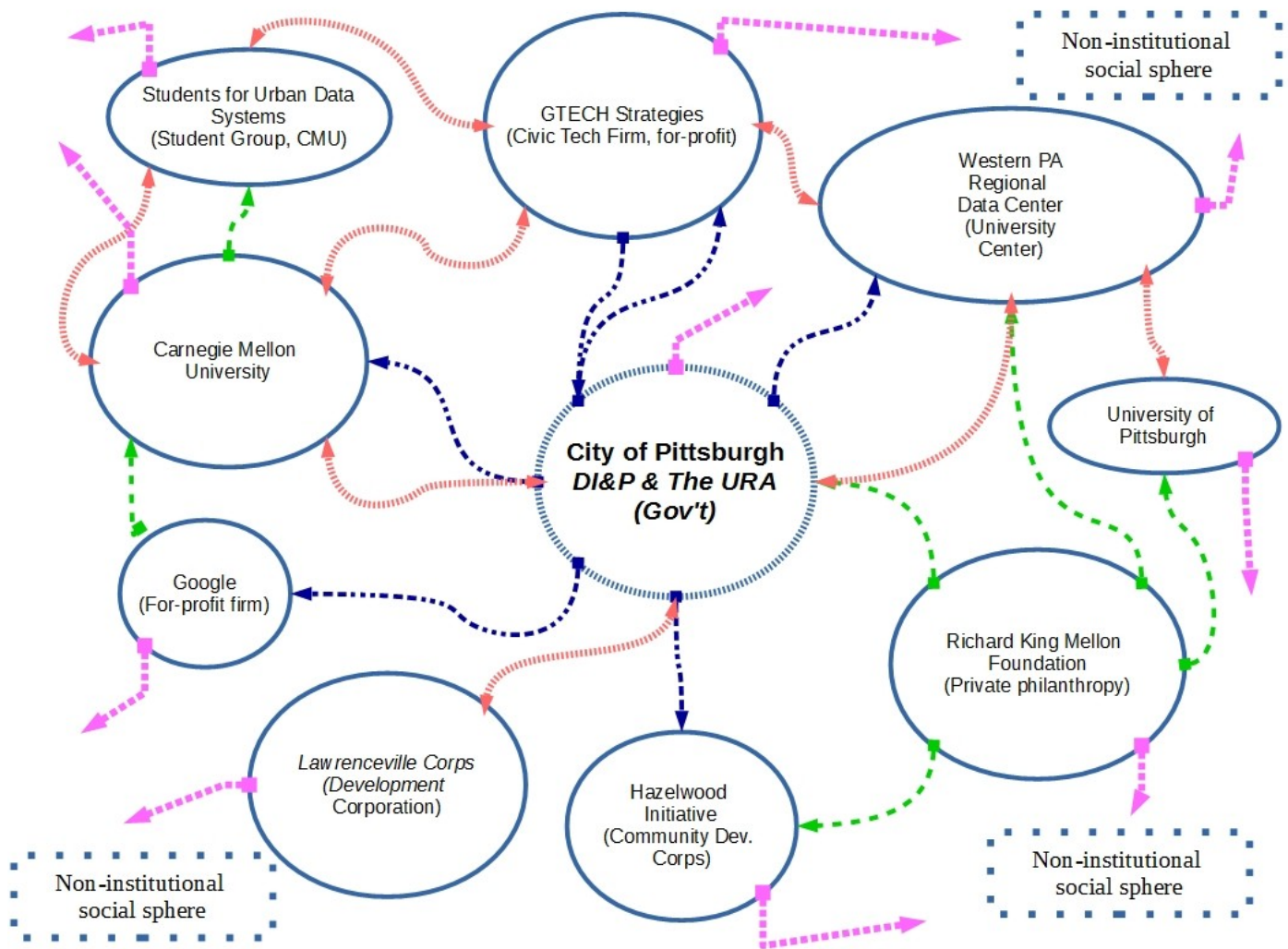


Figure 6: A network schematic of civic tech in Pittsburgh

KEY: Short-lined arrows (red): partnership relationship | Blocked arrows (magenta) pointing outward: social capital flows | Rectangular arrows (blue): data and information flows | Long-dashed arrows (green): money flows

Given the difficulty of arriving at a useful taxonomy for categorizing the types of entities within the civic tech sphere, the nodes in figure 6 include the generally accepted category of institution in parenthesis under its official name. The network arcs connecting the nodes however, can be grouped into four classes, each representing a type of flows through the network: flows of financial capital, flows of institutional trust, flows of information, and the desired outcome flow of social capital.³¹ Section 2 will expand on the ways in

31 Microsoft (of all corporations) is interested in civic tech, too, and created an interactive network exploration tool available via <http://civicgraph.io/>. I cited it here because Microsoft represents four kinds of flow through its social capital network diagram:

which the flow arcs can be leveraged by the city to generate maximum amounts of social capital among all citizen subgroups in the city.

Note that the network diagram contains only institutional actors and arcs connecting them to one another. The oddly shaped arrows emanating from each institutional entity and pointing into the marginal space together depict the process of each entity creating social capital among city residents (who are represented by three copies of a rectangle with a permeable, dotted border). The depiction of social capital flows proceeding out from—but not directly in to—other institutions suggests that social capital is inherently a creation between individuals. While institutional actors can facilitate and enable this generative process, the core outcome of the civic tech market is greater cohesion among individual people, not between institutions.

The residents of the city of Pittsburgh who are struggling to meet their basic needs in a climate of economic hardship and limited opportunity fundamentally do not need more institutional actors creating more growth plans; individuals in Pittsburgh need more security, more stable income, and more access to opportunities. The desired outcome of civic tech entities should be centered on creating more of these outcomes and should therefore see creation of additional node-to-node connections through processes such as partnership agreements or grant making as instrumental to social capital creation and not ends in themselves.

Clayton Christensen's Theory of Disruption and the birth of civic tech

Before exploring the implications of our civic tech model for Pittsburgh, a note is in order about the origins and overall impact of civic technologies themselves on the larger market for technology and civic engagement tools. Harvard Business School professor Clayton Christensen's popular—yet contented—theory of disruptive technology assists us in making such an assessment. In his seminal work, *The Innovator's Dilemma*³², Christensen attempts to answer the question of what mechanisms were at play when some notably “great” for-profit entities have experienced startling declines as a result of new technologies entering their market spheres. To do so, Christensen disambiguates the notion of *technology* and *innovation* in order to classify each with more specificity than when the terms are used in general conversation.

funding, data, employment, and collaboration. Their work was influential in the development of my model, but not definitive. Their model also includes individuals within the civic tech sphere which is an approach that I decided against for reasons elaborated in the essay.

32 Christenson, Clayton. *The Innovator's Dilemma*. 2003. Harper Collins: New York. p.3.

His analytical approach involves classifying technological developments as either *sustaining* in character, or, more rarely, *disruptive* in their impact on the existing market. One prototypical example of a *sustaining* technology is the advent of flash RAM storage (e.g. USB “thumb drives”). Toshiba's development of affordable and reliable flash RAM storage changed the landscape of data distribution and storage irreversibly. Entire product lines such as optical disk storage were rendered *old* technology with startling speed.³³ While common vernacular might call changes of this magnitude “disruptive,” Christensen asserts that an innovation like flash memory is best classified as *sustaining* because it was developed by an industry-leading firm for the “high end” of the market—customers willing to pay higher prices for more advanced technologies. He reserves the label of *disruptive* technology for innovations which, when introduced, appear to the industry mainstays as less featured and therefore less appealing to their core market. Disruptive technologies are often ignored when they appear but wreak havoc later.

Henry Ford's assembly line technology and its production of the Model-T automobile is a meaningful example of disruptive technology.³⁴ As a relatively minor player in the automobile market, Ford began selling its new machines to “low-end” customers who could not afford vehicles sold in the existing car market and therefore did not require the luxuries that were quickly being injected into the newest and most exciting automobiles of the day. Industry leaders were soon threatened financially, however, by Ford's stripped-down Model-T vehicle. Priced in the range to be accessible even to the assembly line workers who build the units, the Model-T quickly became a common fixture on American roadways, much to the chagrin of existing market leaders.³⁵

In other words, Christensen's disruption involves what might be termed “underdog innovations” which rapidly develop in quality such that industry leaders are later displaced or entirely new markets are generated. Christensen claims that market leaders are often threatened by this special class of innovation because they actually *overshoot* their target market by improving their core products *too much* and, in the process, do not entertain the possibility that more profit lies in wait to be captured by actually creating products with fewer features which can be sold to customers who would not otherwise buy the higher-end good.

33 See Fulford, Benjamin. “Unsung Hero,” *Forbes*, 6/24/2002. Accessed on 1/29/16 via <http://www.forbes.com/global/2002/0624/030.html>.

34 See Christensen, Clayton, *The Innovator's Solution*, p. 49 (Harvard Business School Press: Boston, MA, 2003) for a discussion of the Ford case.

35 This development process was detailed in Eric Darsow's essay #1 for the Disruptive Technology course at CMU taught in Fall of 2016.

Thus the distinguishing feature between the two types of change is not the degree to which a technological development changes how users interact with a device or machine. Rather, Christensen-style disruption occurs as follows:

Once the disruptive product gains a foothold in new or low-end markets, the improvement cycle begins. And because the pace of technological progress outstrips customers' abilities to use it, the previously not-good-enough technology eventually improves enough to intersect with the needs of more demanding customers.³⁶

The non-intuitive notion of *disruptive* technology offers a useful insight into the behavior of innovations within the civic tech sphere. Among the many civic technologies mentioned in this analysis, the development of the GNU/Linux operating system occupies a special place in the civic tech ecosystem. As a Free and Open Source (FOSS) operating system compatible with all x86 processors (those found in most PCs today), GNU/Linux serves as a critical platform on which many other civic-focused innovations are installed.³⁷

The development of this robust operating system mirrors the general characteristics of Christensen's disruptive technology. Driven by a few stalwart open source programmers, most notably Richard M. Stallman and Linus Torvalds, the GNU/Linux package was initially introduced as a free software base that was difficult to install, offered users only a simple command line interface, and required continual technical adjustments to remain compatible with software written to run on the platform.

While the particulars of the development of GNU/Linux is fascinating and extremely relevant to understanding dynamics civic technology from a technical perspective, the relevant portion of the narrative underscores how GNU/Linux was created for what Christensen would call a "low-end user," namely the hobbyist who was not inclined to pay what many considered outrageously high license fees for the more featured (but arguably lower quality) Windows operating system. Created by Bill Gates' Microsoft corporation, Windows was designed to align to the interests of customers willing to pay money for additional features and system upgrades which are introduced every few years. Indeed, Windows buyers were purchasing a system complete with a graphical user interface, vetted hardware drivers, and a suite of compatible software packages which customers could even pay to have pre-installed on their machines.

³⁶ Christen, Clayton, *The Innovator's Solution*, p. 34.

³⁷ For a discussion of market permeation of GNU/Linux see Wheeler, David. "Why Open Source Software / Free Software (OSS/FS, FLOSS, or FOSS)? Look at the Numbers!" Section 2: Market Share. Citing a Nov 1, 20014 Information Week Survey of companies. Accessed on 5/1/16 via http://www.lions-wing.net/lessons/whynot/oss_fs_why.html.

Aligned with Christensen's stated trajectory of *disruptive technology*, GNU/Linux was improved rapidly by volunteer programmers around the world who were able to share their improvements freely on the internet under the protection of the GNU Public License (GPL). The GPL allows for—and indeed required—that the code falling under its terms be forever freely modifiable and distributable. In the spirit of many other open source civic tech projects which abound today, the GNU/Linux operating system was incrementally improved such that today a significant fraction of web servers run copies of the operating system,³⁸ an act tantamount to *market sabotage* in the eyes of closed-source software vendors who, years ago considered a hobbyist-built system a laughable competitor. These firms today no doubt cringe at the thought of the forgone billions of dollars of license fees they will never collect.

2. Suggestions for harnessing the characteristics of the civic tech market to foster inclusive growth

Section 1 has laid a solid foundation on which the following core suggestions for the Pittsburgh Department of Innovation and Performance rest. Each of the following suggestions flows out of the civic tech market fundamentals established above.

Leverage the power of Free and Open Source Software (FOSS)

The Roadmap's third focus area to “provide open data to Pittsburgh” is well-grounded in the spirit of civic technology and the positive network effects that can be realized by releasing data about government operations to the public. This focus area should, however, be conceptually expanded to emphasize the important role that Free and Open Source Software (FOSS) plays in the open data ecosystem in which the city currently participates.

The previous sub-section which outlined the peculiarly disruptive nature of the GNU/Linux code base provides a template for realizing even greater benefits from the well-established legal regime which has been developed to preserve FOSS code bases worldwide. Known as a *copyleft*, open source technologies employ a carefully crafted copyright agreement that instead of restricting use of the code by others actually guarantees that no user can infringe on another user's ability to creatively use, modify, and share that code indefinitely.³⁹ The City's collaborative partnership with the University of Pittsburgh and its Center for Social

38 Netcraft maintains an ongoing survey of web server market share. The September 2015 report shows Apache and Nginx (both of which run on GNU/Linux) together capturing over half of the total market. See <http://news.netcraft.com/archives/2015/09/16/september-2015-web-server-survey.html> for the full report.

39 Volumes have been written about every nuance of the open source licensing process and its impacts on the tech industry. Many texts are published freely under open source documentation licenses as well. One such text is Rosen and Einshlag, *Open Source Licensing Software Freedom and Intellectual Property Law*, 2004 (Prentice Hall). Accessed on 1/29/16 via <http://linuxclass.heinz.cmu.edu/doc/Open-Source-books/Open-Source-Licensing-Book/>.

and Urban Research (UCSR) has already benefited greatly from the fact that the Western Pennsylvania Regional Data Center (WPRDC) is itself built on two critical open source code bases: the GNU/Linux operating system and the CKAN data portal software package.⁴⁰ The fact that UCSR was able to roll out its platform on existing technologies in a free and non-restrictive fashion has greatly enhanced the efficiency and malleability of the backbone of WPRDC open data endeavor.⁴¹

The DI&P has ethical reasons for prioritizing open source code bases in order to be responsive to the call by the FOSS community which is simply to contribute meaningfully to the particular FOSS communities from which one uses code.⁴² Additionally, from the standpoint of realizing truly inclusive change in Pittsburgh, the City should take the following concrete steps to orient the benefits of FOSS to the Pittsburgh community:

- In negotiating with partner agencies and institutions on technical projects, insist on using free and open source software wherever possible. Doing so has several benefits: by insisting on using FOSS, the city can become a thought leader in our community which is home to many for-profit technology companies who are often inclined to keep their source *closed* and profit financially from its copyrighted distribution. Thus, in the spirit of working for a more just community in which one's income does not dictate one's quality of life, the city should promote this value ruthlessly in its technology endeavors which, of course, constitute the core driver of growth described by The Roadmap.

Insisting on using FOSS in all its technology endeavors also helps the city in practical ways by avoiding the trap of vendor lock-in which is endemic to the closed source platform environment. While FOSS can require more upfront investment to configure and modify to one's own use case, by doing so and sharing the changes made with the larger community, the code base in question continues to grow and evolve in ways that generally promote greater inter-operability rather than less. Less inter-operability is the intended goal of many for-profit software vendors whose financial success depends on customers continuing to pay licenses and maintenance fees for use of their

40 CKAN's main website is ckan.org and its creator is the civic tech nonprofit called the Open Knowledge Foundation, <https://okfn.org/>.

41 The WPRDC's history is well documented. See http://www.neighborhoodindicators.org/sites/default/files/publications/pp_nnip_open_data_pittsburgh_mobile.pdf for part 1 of its history and <http://rgradeck.blogspot.com/2014/06/open-data-addendum-to-nnip-partners.html> for part 2, each written by Bob Gradeck, the WPRDC and open data CZAR in Pittsburgh.

42 Stallman wrote The GNU Manifesto in 1985 to declare the philosophical drivers behind the FOSS project he still leads to this day. Accessed on 5/7/16 via <http://www.gnu.org/gnu/manifesto.en.html>.

proprietary code base.

- When funding or coordinating the development of new tools, insist on discussing the licenses under which the resulting code bases will be released. The DI&P should investigate carefully the range of open source licenses available and choose the version of the license which is referred to as *the most restrictive*, meaning the most likely to require users and developers to maintain the same open source privileges for all future modifications of the code base in question. In this fashion, the City will not only be contributing the meaningful outcomes by developing software for civic tech related projects in town, but can promote the ability of other cities and agencies to do the same in the future for their residents.⁴³

Activate network effects through data subsidies and “unlikely” partnerships

The City stated its worry about resource constraints inhibiting the implementation of The Roadmap's key goals. Strategically leveraging the network effects that exist within the civic tech ecosystem is a core way to create inclusive benefits for the residents of Pittsburgh while efficiently using taxpayer funds. To do so, the concept of direct and indirect network effects should be embraced and carefully implemented.

Reviewing Figure 6, the network schematic of the Pittsburgh civic tech market, reveals myriad connections between entities, each of which has its own core interests and constraints. A positive, direct network effect is created when increased participation in a particular segment of a network creates additional value for the other users of that same segment. Successful social media websites, for example, leverage this phenomenon to secure astronomical advertising revenues; as more individuals actively use a given social media site, the worth of that tool increases for the existing users because more content is available for consumption across a wider range of topics. In the social network space, this effect is immediately obvious—the use of a social media site without others with whom one wants to socialize is essentially a zero value proposition.

The DI&P can mimic this phenomenon across entities in the civic tech sphere by using government data as a kind of subsidy to increase the use of existing technology platforms, such as the WPRDC. A comparison to strategies employed by for-profit tech firms, once again, provides a useful template for action: a firm such as Airbnb uses financial subsidies in the form of offering prospective property renters a free browsing portal and low-cost booking fees. Their model is slightly more nuanced when one considers that Airbnb acts

43 See the WPRDC's data license for some great reading on this process: <https://www.wprdc.org/data-licenses/>.

as an intermediary between two “sides” of the property rental market: property owners on one side and renters on the other. By extracting fees from the property owners who stand to gain financially from a vibrant market, Airbnb is, in effect, subsidizing the renter market.⁴⁴

The City of Pittsburgh does not rent vacant apartments, but rather is attempting to stimulate the network effects of a multi-sided civic tech market. And instead of covering operational costs for “one side” of the market as Airbnb does, the DI&P can consider the internal data collected and stored by existing government entities as a pool of relatively low-cost resources which it can strategically inject into the civic tech sphere to incentivize the creation of beneficial applications of data-based technologies that use open government data. This strategy is based on the generally accepted principle that governments run more effectively when citizens can hold it accountable for carrying out the projects it undertakes in the most socially upstanding way possible. In fact, The Roadmap already acknowledges the importance of this process. In its open data focus area, priority task #1, the authors note that the city should: “Work with local civic software programmers such as the Pittsburgh Code for America Brigade to engage community members with Open Data to build tools and visualizations that help everyone better understand our community.”⁴⁵

While The Roadmap states its intention to invite other nearby municipalities to contribute data to the WPRDC platform, it falls short of clearly stating its intention to work with the existing departments in the Pittsburgh city and county governments to release more of its operation and evaluation data to the public sphere. While the WPRDC currently contains a variety of useful open data sources such as the property assessment exploration tool, real-time updates of 311 call data, and daily police blotter data, its database contains data holes which, if filled, have high potential for increasing the quality of life of broader segment of Pittsburgh residents than is currently served by the currently released data sets.⁴⁶

The Allegheny County Department of Human Services, for example, coordinates many programs and services for the population subgroups that stand the most to benefit from (and therefore experience the greatest current need) a more inclusive growth strategy. And yet, the WPRDC currently contains only one substantive data set concerning the operation or impacts of human services programs—a listing of fatal

44 Notes on Airbnb's case were accessed via the Heinz College Managing Disruptive Technology Course, Spring 2016.

45 The Roadmap, page 14.

46 The city's open data efforts has received plenty of press, such as this report in statescoop: <http://statescoop.com/pittsburgh-allegheny-county-team-new-open-data-portal/> and this report by govtech, a center for news on government and technology <http://www.govtech.com/data/Pittsburgh-to-Take-Holistic-Regional-Granular-Approach-to-Open-Data.html>.

overdoses by year.⁴⁷ While there are certainly privacy concerns inherent in releasing human services data, such hurdles can most easily be surmounted by a department tasked with promoting open data like the DI&P; additionally, there exist generally accepted ways to aggregate data so as to strip it of any personally identifiable information.⁴⁸ With care, the city should coordinate with the county to implement technical systems that are capable of regularly releasing as much data regarding the extent, impact, and efficiency of critical human service areas such as food and rent assistance programs.

While the process of releasing government data is, indeed, complicated, the benefits to the activated network effects are great. In fact, releasing health data will trigger what are known as indirect network effects as well. The immediate, direct network effects that will stem from subsidizing the civic tech market with data include increasing the value of participation in the groups directly linked to open data, such as Pittsburgh's Code For America Brigade.⁴⁹ As civic tech groups like this are enabled to better serve the community by creating tech tools for other citizens to use in calling for higher quality city services, the improved health of citizens that results from such activism indirectly creates added value in myriad unexpected ways. The notion of social capital production provides a key analytical tool here: as citizens are empowered to hold their government accountable for more efficiently administering public assistance services, the act of coordinating efforts based on publicly released data from DHC will generate social capital in the form of trusting relationships between citizens who can then fuel further improvements in the quality of life in Pittsburgh that may not be impacted by open government data at all.

Conclusion

The City of Pittsburgh's Roadmap for Inclusive Innovation is a bold initiative for improving the lives city residents, many of whom are suffering immensely in the wake of a brutal period of de-industrialization. The era has passed of stable, union jobs on which a family can support the raising of children, saving for retirement, and experiencing meaningful leisure time. Mayor Bill Peduto rightfully has championed the need for the Government to take active steps to remedy a situation for it did not create; macro-economic forces outside of its control resulted an economic environment in which relatively lower labor located overseas drove massive offshoring of what were once mainstay jobs for thousands of city residents.

This analysis has sought to provide guidance to the City's new Department of Innovation and Performance

47 See <https://data.wprdc.org/dataset/allegHENY-county-fatal-accidental-overdoses> for direct access to this data set.

48 O'reilly publishing, a champion of free technical books published online, catalogs a text called "Anonymizing health data" and is available via <http://shop.oreilly.com/product/0636920029229.do>.

49 The Code for America Brigade's name is Open Pittsburgh, often called just OpenPGH. Website: <http://opgh.org/>.

which has been tasked with implementing a growth plan centered squarely on the promise of technology driven growth. Indeed, the city's assessment that technology-driven growth holds much promise seems warranted. Pittsburgh is the home of Carnegie Mellon University, a prominent technical research university, and the University of Pittsburgh, a flagship state university known worldwide for its remarkable research output and health care industry. Additionally, major tech companies such as Google and Uber have invested millions in establishing offices in town which, in turn, provides a rich environment for many start-up firms working in diverse technology related challenges to thrive.

The core challenge, however, is to ensure that this tech-focused growth not only avoids creating catastrophic gentrification effects but actually stimulates growth that is, as the city describes, inclusive of all segments of the population. To do so, this analysis has argued that the City must proceed with a robust understanding of the new and largely amorphous civic technology field in which The Roadmap will be implemented. To aid in this process, a network schematic has been developed as a tool for systematically applying data-based subsidies to technology groups that bridge citizens and public data and strategic partnership. A number of concrete recommendations have been made to the city for interacting with the civic tech market in ways that create social capital by activating direct and indirect network effects.

Recommendations include insisting on using open source software whenever possible while implementing The Roadmap, including ensuring that new technology tools developed by city partner agencies are released under open source licenses which will enable city residents to use the tools to their maximum capability at the lowest possible cost. Doing so will also allow other cities across the globe to use the tools in their own jurisdictions. Finally, a challenge was issued for the City to coordinate the release of more open government data, particularly data that pertains to the administration and evaluation of human service programs which provide essential support to the city's most vulnerable populations.

In this era of rapid change, much of which is incident to technology developments, the City of Pittsburgh should be applauded for taking a leadership role in creating The Roadmap in a participatory manner. The challenge of the future is to carefully consider how the unexpected changes within the technology field can be channeled into creating a more vibrant and health environment for individuals historically positioned outside the bounds of this elite and often opaque field of capitalist development. By forging strong, value-driven partnerships with civic tech entities which share the City's commitment to inclusive growth, Pittsburgh stands to re-emerge yet again as a thriving center of life and industry in the USA.