Sustaining Community-Based Research in Computing: Lessons from Two Tech Capacity Building Initiatives for Local Businesses

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The field of human-computer interaction (HCI) has traditionally focused on the design of novel technology artifacts. However, ensuring considerations for artifact maintenance and repair is crucial to sustainably supporting the populations they aim to serve over the long term. Drawing on two multi-year programs for tech capacity building in post-industrial U.S. cities, this article presents a comparative analysis to investigate the challenges and strategies for sustained community-based research in computing. In particular, our work detailed three considerations for academic-community partnerships. First, long-term partnerships prioritized transferring trust across academic and community personnel and continually set expectations that responded to evolving community initiatives (i.e., *relational* sustainability). Second, partnerships used academic support as a way to kickstart community initiatives, and flexibly reframed interventions to stay aligned with evolving community goals (i.e., *economic* sustainability). Third, partnerships trained personnel to provide technical support alongside interventions and prioritized advice that resisted short-term trends (i.e., *technical* sustainability). We provide concrete examples of how our two academic-community partnerships carried out such suggestions—such details go unreported in scholarly articles yet are essential for sustainability considerations. We discuss ongoing challenges, such as rethinking when longevity should and should not be the end goal.

CCS Concepts: • **Human-centered computing** → *HCI theory, concepts and models.*

Additional Key Words and Phrases: Sustainability, Community-Based Research, Technical Capacity Building, Business, Entrepreneurship, Technology

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1 INTRODUCTION

Community-based research in computing aims to engage community members and researchers in collaborative research to address community ideas, desires and needs while mitigating power imbalances across stakeholders [41]. These approaches prioritize the "community," typically defined

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by a shared geographic location and common goals [17]. In this context, community members often lead in driving the research processes [19]. At the same time, researchers might act as facilitators, supporting the community's initiatives and needs rather than directing the process [77]. Priorities of such approaches include relationship building among stakeholders that is based on trust [48, 55], commitment to the community and its well-being throughout the lifetime of the project and beyond [77], and accounting for alternative sites of knowledge production not typically espoused in academic histories due to institutionalized racism [22, 34]. Taken together, community-based approaches in computing research present opportunities to work towards more socially just futures [22].

However, sustaining[1] community-based approaches presents an ongoing challenge within computing [19, 49, 53, 57, 65, 67, 77]. In particular, the field of computing's myopic and extractive tendencies [37]—and histories of harm and erasure as a result [34, 35]—warrant a deeper interrogation of the challenges with sustaining community-based research [53, 65]. For instance, the prioritization of short timelines and technical novelty over maintenance, repair, and other forms of wraparound support complicates paths towards sustainability [37, 44, 69, 73]. In addition, community-based approaches often entail relational investment. Yet, students who lead initiatives have short tenures, and the work involved in building such relationships is often deemed not within the realm of computing research given its longitudinal nature [42]. More practically, economic challenges arise due to short-term funding cycles [41] and incongruent goals between commercialization and community objectives [19, 73]. While these challenges are increasingly well-documented across human-computer interaction scholarship, there are few accounts of the strategies and tactics used to counteract or address these challenges (with notable recent exceptions, e.g. [49, 77]). Such strategies and tactics may be especially useful in the context of technical capacity building among workers as the rapid digitization of labor, alongside little long-term support for workers, exacerbates the digital divide [44, 45, 56].

Thus, this article investigates ways to sustain community-based research in the context of two technical capacity-building programs created in partnership between university researchers and local community organizations. By technical capacity-building programs, we refer to programs housed in neighborhood community organizations where service providers give one-on-one tech support, in this case, to local micro-entrepreneurs and small businesses to facilitate local economic mobility [30]. These programs, which occurred in two post-industrial cities in the United States, involved extended engagement with both the community partner organizations and community members, providing a valuable context to study sustainability efforts in community-based research. We situate these programs within a larger context of recent national interest in technical capacity building, or "upskilling" [2, 12, 68]. For instance, rather than enjoying the benefits of improved working conditions and work-life balance promised by those attempting to eradicate menial labor and managerial processes [47, 81], workers are increasingly displaced by technological advancements [36]. With limited to nonexistent government or employer support programs to facilitate transitions to higher-skilled jobs, US workers are simply not supported in the "reskilling" transitions required to "outpace automation" [3]. Moreover, low-income and working-class communities are now worse off with these technological shifts in labor due to increased gentrification, segregated neighborhoods, and fewer opportunities for cross-generational wealth building [26]. These trends are further magnified for communities of color, where race and class intersect with compounding effects due to transgenerational racist institutions and poverty [11].

[1]We use "sustainability" in this context to refer to facilitating a project's longevity in a resource-efficient manner rather than solely environmental sustainability [25, 72].

Therefore, the guiding questions this article addresses by comparing the two technical capacity-building programs include: *How have these two programs for technical capacity building sustained their community-based projects over the past several years?* And, *What qualities in an academic-community partnership are supportive (and unsupportive) to sustaining technology support for local entrepreneurs?* By using a comparative case study approach, we compare and contrast our different projects to help identify shared practices and gain a deeper understanding of how each project uniquely addresses the challenges involved in achieving sustainable outcomes [73].

By reflecting on our combined experiences, we first contribute conceptual lessons learned—animated with concrete examples—of sustained small-scale technical capacity building in lean economies[2] with respect to **relational sustainability** (e.g., transferring trust across providers, expectation setting with community partners and entrepreneurs, overseeing and teaching practices of care, building on existing connections between institutions), **economic sustainability** (e.g., allocating funds for community personnel and resources from the beginning; flexibility in reframing interventions to stay in alignment with evolving community objectives and community funding requirements, helping communities collect data for internal purposes to be able to garner more funding), and **technological sustainability** (e.g., providing contextualized guidance on tech investments and targeted advice that cuts through hyped rhetoric, training in technology use, and resilience rather than providing answers). Second, we build on existing scholarship on community-based research to develop sustainable (and unsustainable) practices to support community-centered academic partnerships over the long term. Finally, we provide empirical evidence in centering the voices of community partners on what sustainability means to them through specific case study results. Together, addressing issues of sustainability in community-based research responds to calls by human-computer interaction scholars to provide detailed accounts of the messy, behind-the-scenes work that is often required in community-based research but which often goes unreported in computer science publications [55, 77].

2 RELATED WORK

2.1 Community-Based Research

Community-based research (sometimes umbrellaed under community-collaborative approaches or "CCA" [19], community-based collaborative design [41] and community-based participatory design or participatory research or "CBPR" [70]) is intended to engage community members and researchers in collaboration to conduct research and derive solutions based on the community ideas, assets, desires, and needs while aiming to balance power dynamics across stakeholders [46]. Unlike participatory design set in the workplace where organizational goals and commercial pursuits indicate clear leaders and objectives [13], local communities united by geography comprise mixes of motivations, goals, and histories [41, 55]. In contrast to service learning, where the primary goal of academic-community partnerships is to emphasize pedagogy in the real world [6, 16, 74], community-collaborative approaches prioritize the community's agenda and needs with as much weight (if not more) than academic agendas and pursuits [42].

Part of the promise of community-based approaches is that the solutions derived are meant to be more effective than alternative solutions which result from traditional human-centered design processes [17]. This is because community-based approaches engage stakeholders as collaborators—rather than solely users—and hearken community wisdom not traditionally surfaced in the design process [19, 55]. To engage communities effectively can require reorienting the traditional HCI paradigm to prioritize alternative sites of knowledge production outside the bounds of traditional

[2]A term borrowed from [10] referring to environments where community members manage slim resources innovatively and resiliently.

institutions and to facilitate non-experts throughout a design process [66, 70, 82]. Therefore, heightened attention to power dynamics across stakeholders—which has been traditionally left out of or ignored in interventionist design research [33, 34]—is essential [15]. These often unspoken power dynamics include hierarchical and racialized relationships between "researchers" and those being "researched" [79, p. 1], where ways of knowing often center institutionalized epistemology [66, 79]. For example, Harrington *et al.* interrogated traditional research practices when working with marginalized communities to find that design activities like blue-sky ideation can undermine and infantilize participants' lived experiences [41]. However, when community-based approaches are done well (e.g., communities are in the driving seat of the research process), they can empower communities by supporting community ownership over design outcomes [22]. In this paper, we build on this scholarship by investigating how community-based approaches—and the intricate academic-community partnerships which underlie these approaches—are sustained over the long term.

2.2 Sustainability in Human-Computer Interaction and Community-Based Research

Historically, sustainable human-computer interaction (SHCI) literature has focused on certain kinds of sustainability, such as lessening the environmental impact of technology [29, 40, 51, 59, 67, 72]. While such considerations are critically important, other aspects of sustainability should be considered to more readily account for other stakeholders' notions of sustainability beyond computing researchers [25, 67]. For instance, the United Nations recently articulated well-rounded sustainable development goals, including responsible consumption and production, sustainable cities and communities, and Zero Hunger [40]. In light of these wide-reaching sustainability goals, HCI researchers coined "future-proofing" [73] as a generalizable term which means "to equip for or protect against future developments; to design in a manner aimed at preventing rapid obsolescence" [64]. Alongside these field-wide endeavors to widen the scope of sustainability research, community-based approaches have similarly developed to account for mounting complexities. For instance, while early efforts to sustain community-based technology design prioritized linearity and maintenance of a single intervention [18], recent work detailed the twists and turns of community-driven research [53, 55, 77]: Tandon *et al.* described in their account of community-driven development with a local taxi union how their efforts required constant engagement, malleability, and iteration of partnership goals [77]. In particular, the authors described the need for the research team to constantly adapt to the evolving demands of their community-based research project as they provided community partners with various types of support such as: design, technology implementation, technology assessment, and market research. In doing so, they provided a detailed account of "the work to keep the work going" [77, p. 5].

In addition to researchers' malleability, community ownership and financial considerations are important for project longevity [62]. For instance, Merkel *et al.* discussed how when community partners maintained ownership of the resulting technological artifacts, they ultimately had greater control over the project and were empowered to learn the necessary skills to maintain the artifacts [62]. In addition, in a recent literature review of community-collaborative approaches, Cooper *et al.* discussed the importance of community stakeholders' technical skill development through project participation (e.g., data management and data collection), as this engagement helped support long-term efforts [19]. In terms of financial considerations, Simone *et al.* outlined difficulties in achieving sustainability, such as research funding models and, consequently, time, which are inherently finite, conflicting stakeholder interests, and temporal project frames of projects throughout a project lifetime. In their "lessons learned" paper on the Civic Nexus project, Merkel *et al.* discussed how when "designing for sustainability" for technological projects, there is a "danger" when funds run out, and communities are left with the technology they may not know how to maintain [62, p.

6]. Moreover, shifts in community partners' objectives, programming, and funding create a need for constant adaptation and oversight [77]. In this article, we build on this scholarship in two ways: by considering sustainability in the context of "economic growth and decent work" (UN Sustainable Development Goal #8 [40, p. 3]), and by investigating the infrastructure required to enable the skill building and financial planning that is important for long-term technology engagements with community partners.

2.2.1 Trust and Relationships in Sustainable HCI: Challenges and Strategies for Long-Term Engagement. A growing body of work in sustainable HCI research focuses on how trust and relationships are a central pillar to successful engagements. Within the context of Digital Civics, Corbett and Le Dantec discussed how a technological intervention within local government may be incongruent with how trust is traditionally built between citizens and their governments [20, 21]. For example, they discussed the importance of collectively articulating goals and meeting people where they are to ensure communication and connection [20]; in contrast, computing researchers often establish goals before working with local citizens. Dickinson *et al.* found that taking an assets-based approach when designing and deploying civic technology worked well only when it was embedded in social relationships between citizens and their city government [24]. In forming publics through participatory design, Le Dantec and DiSalvo argued that "a central component of infrastructuring toward a public is the process of identifying and forming attachments" [23, p. 242]. In particular, through a comparative case study, they analyzed how a community's attachment to a community radio show—which resulted from a community-based design project—was key to the success of the project and helped to commemorate local history. Taken together, these works highlight how trust building is essential between the communities and governments involved, in order for projects to be successful.

Beyond digital civics, recent work in HCI has provided an in-depth look at the initial rapport building required at the onset of academic-community partnerships. For instance, to successfully build relationships with community partners, academic teams can volunteer in the community, familiarize themselves with local histories, reflect on their own identities and standpoints, and set expectations and mutually beneficial goals [41, 55, 78]. And while this work has thoroughly detailed initial rapport building activities, there exists less work on detailing how to *maintain* those relationships over time [48, 77]. Such details are critical for strengthening community-based approaches, as it is problematic when researchers commit to long-term collaborations but then fall short, such as when academic contributors complete their degrees or move elsewhere to continue with their careers [41]. Therefore, in this paper, we contribute to the scholarship in HCI committed to fostering sustainable engagements between academic researchers and community partners. Specifically, through a comparative case study, we build on related scholarship by articulating the details of sustained relationships between academic and community partners across two small-scale, technical capacity-building programs in the United States.

2.3 Small-Scale Tech Support for Local Businesses

As shifts in the economy require workers to become increasingly digitally skilled to outpace automation (sometimes called "reskilling" or "upskilling"), entrepreneurs find themselves similarly needing to adopt technologies to start, maintain, and scale their businesses [7, 28]. However, predominant approaches for "reskilling" such as technology bootcamps fail to provide entrepreneurs with well-rounded support, including an overemphasis on onboarding, learning flashy tools without entrepreneurial context (e.g., coding boot camps), no maintenance support (e.g., one-and-done), little attention to relational aspects of support, and failure to adapt resources to latest tech needs (i.e., resources quickly became irrelevant given the fast pace of technological change) [26, 44, 52].

Therefore, recent work in HCI investigated alternative approaches to technology support for workers. For instance, Ogbonnaya-Ogburu *et al.* established a digital literacy class for returning citizens seeking jobs [63]. In their course series, they center relationship and trust building by focusing on the role that family and friends play in equipping returning citizens with digital skills. Hui *et al.* introduced low-tech social supports (e.g., in-person meetings, paper prototyping, live practice) for entrepreneurs building digital capacity for running local tour businesses [44]. Lee *et al.* outlined hybrid online and offline training programs to support digital upskilling among public housing residents [56]. In these models of tech support, the relationship building required to successfully acquire digital literacy skills was best supported in offline and social environments. Such models of offline social support centered trust building by demonstrating the importance of trainer-trainee and peer engagement to overcome the fear of technology and low technology confidence. For instance, Dillahunt *et al.* facilitated opportunities for entrepreneurs to grow their businesses with technology via in-person, peer support groups [26], and Kotturi *et al.* presented a technical support program between entrepreneurs and local experts which addressed the wide-ranging, everyday computing needs of entrepreneurs [52]. Together, this work uncovered the technical barriers specific to local entrepreneurs who power their businesses with technology. We build on this scholarship by providing a longitudinal analysis of tech support programs that collectively spanned six years, thus addressing a critical gap in how to sustain such programs with limited, grant-based funds.

3 BACKGROUND

In this section, we provide a brief overview of the background context for each case study such as information about the geographic locations, community partners, universities, tech support programs, and research designs.

3.1 The Two Cities

Our studies took place in two U.S. cities which continue to navigate resurgence after decades of post-industrial blight. Pittsburgh, PA is a middle-sized city located in the northeastern part of the U.S, while Detroit, MI, is a larger city in the mid-western United States. Both cities are rich in industrial backgrounds and have diversified their economies since the decline of their main industries several decades ago. Pittsburgh, PA began as a manufacturing hub and continues to transform into an economy around healthcare, technology, and education. Detroit, MI's economy is well-known as a manufacturing hub and has continued to rebuild this industry since its collapse a few decades prior. As with many U.S. cities, both Pittsburgh, PA and Detroit, MI have been heavily shaped by the presence of local universities. For instance, in his book "In the Shadow of the Ivory Tower," urban historian and cultural critic Davarian L. Baldwin detailed how universities have plundered cities across the U.S. [9]. Baldwin illustrated through various case studies how U.S. universities have historically neglected, erased, and directly harmed the surrounding communities in pursuit of expansion and prestige. For instance, in addition to university-driven gentrification of the surrounding areas and lack of access to university resources for local residents, extractive research practices have further rippled already tenuous relationships between local residents and university researchers. We therefore situate both Pittsburgh, PA and Detroit, MI as cities that have experienced such ramifications with the presence of Carnegie Mellon University and University of Michigan, respectively. In doing so, we further highlight the importance of following a community-driven protocol, building rapport over multi-year relationships with community stakeholders, and acknowledging historical wrongs specific to the two cites and universities in this study.

3.2 The Two Community Centers

3.2.1 Community Forge in Pittsburgh, PA. Community Forge is a nonprofit organization that provides programming and services to local community members, an affordable co-working space, office space, and cultural events. Founded in 2017, Community Forge focuses on entrepreneurial support and cross-generation wealth building and hosts an annual small business accelerator as part of its Business Service Center. Community Forge is a renovated elementary school building originally built in the early 1900s; the school closed in the early 2000s due to the reduced population and post-industrial collapse. The surrounding residential area, a once bustling neighborhood with working and middle-class families, now faces building closures from abandonment. Community Forge aims to help those from the area to reclaim and revitalize their community rather than outside real estate companies. To do so, Community Forge centers participatory programming that gives voice to those they serve, breaking down silos between communities and developing equitable pathways to economic success. To date, Community Forge's services have been utilized by over 60 local businesses, primarily Black-owned and women-owned, with the most common business types being service-based businesses: notary, transportation, daycare, restaurant, life-coaching, event planning, and cleaning services. Prior to Tech Help Desk, Community Forge had many requests to conduct research projects in collaboration with local universities, including researchers from Carnegie Mellon University. However, Community Forge leadership were weary of the majority of these requests, given the researchers' lack of historical understanding. Residents of Community Forge's neighborhood had vocalized concerns to Community Forge leadership of university intervention, sharing past stories of Carnegie Mellon University's extractive practices and contemporary examples of erasure [1]. Therefore, it was critical that Tech Help Desk not only centered Community Forge's entrepreneurs' needs and provided immediate value, but also that Tech Help Desk providers were informed of the historical relationship between Carnegie Mellon University and Community Forge's local residents.

3.2.2 Jefferson East, Inc. in Detroit, MI. Jefferson East, Inc. is a nonprofit organization that partners with neighborhood residents and businesses to support development, greater resources, and investments. It represents five communities the city views as 13 distinct neighborhoods, covering an area of nearly 20 square miles and representing 42,200 residents. They provide programming and services around neighborhood safety, home maintenance, and economic development within the neighborhood. While Jefferson East, Inc. had provided business-related services (like site location, marketing, community engagement, business plan development, and referral services to the business support organization ecosystem), the program described in this article was the first digital support program provided to business owners in the area. There are more than 500 micro-enterprises in the area served, and most are within walking distance of Jefferson East, Inc., making it an ideal hub for the project. Most businesses are Black-owned and women-owned, with the most common business types being restaurants, retail, and now, e-commerce. Prior to Community Tech Workers, Jefferson East, Inc. has had limited experience working with research teams external to the community. However, representatives of Jefferson East, Inc. have described these few relationships as "extractive" (e.g., requesting data collection useful for researcher reports but not for the community)—a dynamic they wanted to avoid moving forward. For this reason, the program at this site was developed through an assets-based approach that leveraged and contributed to community strengths and values.

3.3 The Two University Partners

The two universities represented—one smaller private, non-profit (Carnegie Mellon University) and one larger public (University of Michigan)—are high-ranking and research-intensive universities.

Table 1. Side-by-side comparison of the two technical capacity-building models for local entrepreneurs. See Appendix for a more detailed comparison.

	Tech Help Desk	Community Tech Workers
Providers	Primarily volunteers from Carnegie Mellon University (students, faculty), one local volunteer	Primarily trained and paid local providers (university students and resident trainees)
Clients	Local entrepreneurs	Local entrepreneurs
Distance to Community Center	5 miles from Carnegie Mellon University	60 miles from University of Michigan
Model of Tech Support	One-to-one or one-to-few provider to entrepreneur(s) ratio, in-person or on Zoom	One-to-one in-person or on Zoom, and in-person workshops for entrepreneurs (20-50 entrepreneurs)
Cost to Entrepreneurs	Free	Free
Topics covered	Broad computing support from organizing files and clearing device storage to building websites and using generative AI	Various business-related technologies (e.g., websites, social media, point-of-sale systems, web ads, search engine optimization)
Longevity	Sept 2019-Present	June 2022-Present

Whereas Carnegie Mellon University emphasizes its educational experience for students and innovation in education and entrepreneurship, University of Michigan, a larger, public mid-western university, strives to serve the people of the state and the world. In addition, while Carnegie Mellon University is physically less than five miles away from its community partner and accessible by bus, University of Michigan is a 1-hour drive from the community partner and primarily accessible by car.

3.4 The Two Technology Capacity-Building Programs

Both universities and community partners designed their programs to support local businesses' technical needs (See Table 1 for an overview of the two programs, and Appendix A for a more detailed side-by-side comparison). Community Forge and Carnegie Mellon University's Tech Help Desk was designed to build the technical capacity of the local entrepreneurs in the surrounding city by providing consistent, long-term tech support from tech experts who are committed to the community partner's mission statement. The tech support model centers relationship building between providers and entrepreneurs through 1:1 or 1:few tech support sessions, reliable and consistent weekly drop-in office hours (twice a week), and side-by-side approach similar to pair programming where providers work next to entrepreneurs. Examples of issues addressed include website building, organizing files, removing malware, optimizing search engine optimization, setting up financial software, and more. To date, the program has worked with dozens of entrepreneurs to address over 200 tech issues. The composition of the community-academic partnership for Tech Help Desk included the Community Forge Executive Director, Community Forge Director of Business Services, several Carnegie Mellon University graduate students and one faculty, and one local resident.

Jefferson East, Inc. and University of Michigan's Community Tech Workers program was designed to expand the city's digital infrastructure for small businesses by recruiting, training, and placing dedicated providers within a community development organization to assess business needs and provide 1:1 support. The program uses an assets-based approach based on a community-driven "train-the-trainer" model and employs locally recruited young adults to help small businesses build

digital skills. This model emphasizes the importance of sharing ethnicity, socioeconomic status, life experiences, and language with the community members they serve. Unlike Tech Help Desk, which uses volunteers, Community Tech Workers's employs its providers, most of whom were from the local neighborhood and the rest university students, many of whom grew up in the greater Detroit area. All members were given training on providing support in a culturally competent way. Community Tech Workers, at the time of writing, had served at least 160 small businesses from the city, focusing on minority-owned micro-enterprises. The composition of the community-academic partnership for Community Tech Workers included the Jefferson East, Inc. Director of Business Services, several University of Michigan faculty, two University of Michigan graduation students, and two local residents.

3.5 The Two Prior Research Studies

The two studies being compared were first performed independently. The Tech Help Desk study took place from 2019 to 2022 [52], and the Community Tech Workers study took place from 2022 to 2023 [45]. Both studies had initial research goals to better understand the technology needs of local entrepreneurs to inform a pilot program that could provide 1:1 support to address these technology interests. Specifically, Tech Help Desk [52] proposed the following research questions: *What are the technology challenges faced by local entrepreneurs?, What are the existing resources and workarounds that local entrepreneurs use to overcome their technology challenges?, and What are features of technology support that may be more effective than common workplace approaches for technology support?* Tech Help Desk took a participatory action research approach, which involved close collaboration between researchers at Community Forge and Carnegie Mellon University to design and implement the program. They also interviewed entrepreneurs and program supporters (e.g., business coaches, lawyers, accountants, web developers). Their findings revealed the importance of tech support programs to address the long tail of computing challenges that entrepreneurs face.

Community Tech Workers [45] started with the research questions, *How might a community-based intervention address the challenges underserved minority business owners face in adopting and using digital technologies?, What are business owners' strengths and challenges to becoming digitally engaged?, and How could a community-based intervention leverage these strengths to overcome challenges to digital engagement?* They took an assets-based community development approach involving in-depth collaboration between Jefferson East, Inc. and University of Michigan to develop and deploy Community Tech Workers. They collected data through surveys with local entrepreneurs, observations of entrepreneur tech support meetings, and interviews with entrepreneurs. Their findings highlighted the importance of technical capacity-building programs to 1) help business owners figure out how to start using technology, 2) offer support grounded in the day-to-day realities of running a business, and 3) build relationships of trust and care.

Both Tech Help Desk and Community Tech Workers are still in service as of the writing of this article. Even though each team's respective community-engaged approach led to a program design that community partners and entrepreneurs valued, questions of how the program would be sustained in the long term emerged as funding dwindled and leadership shifted. This motivation to understand program sustainability was also driven by growing interests in HCI to foster responsible long-term engagement or hand-offs between university and community partners [67]. Thus, members of the research teams of Tech Help Desk and Community Tech Workers decided to engage in a comparative case study to reflect on challenges and lessons learned from program sustainability. The scope of this work is an analysis of the project teams' reflections on their respective program sustainability as outlined in the methods below.

4 METHODS

Comparative case studies are a critical step in theory building as they provide rich insights that, by "recursively cycling" through case data, can inform our understanding of new phenomena and their contexts [31, 54]. In HCI research, comparative case studies have been used in similar contexts to Avle and Hui *et al.* [7] and Le Dantec and DiSalvo [23]. For instance, Avle and Hui *et al.*, through a comparative case study analysis of how entrepreneurs use digital technologies in two low-income urban centers (a U.S. city and a Ghanaian city), provided a detailed description of the "additional labors" entrepreneurs take on to engage in "upskilling," maintain technology to make a living, and overcome exclusion from resources and programs [7]. In particular, it is through the act of comparison and engaging in analogical reasoning that can make salient underlying structures of both projects [76] such that the analysis produces generalizable knowledge about causal questions (how and why each project has pursued sustainability thus far) [38]. We take up a similar approach within the context of two long-term, community-based research projects with the same goals (i.e., small-scale technical capacity building with local entrepreneurs) yet different approaches (i.e., volunteer providers vs. train-the-trainer).

We engaged a qualitative approach through retrospective autoethnography to facilitate deeper conversation across both teams based in Pittsburgh, PA and Detroit, MI [43]. Specifically, we take up a trioethnographic approach—similar to Howell *et al.*—wherein we engaged each other in a reflexive practice through semi-structured interviews and informal discussions over several months. This included four team members from Tech Help Desk in Pittsburgh, PA and three from Community Tech Workers in Detroit, MI– note that both teams comprised academic and community partners [43]. For this project, three researchers led efforts (one from Carnegie Mellon University and two from University of Michigan); the Carnegie Mellon University researcher was also a tech support provider. The dialogic discussions among these three researchers involved researchers as active participants, utilizing their personal experiences as the foundation for acquiring new insights [32]. We coupled these discussions and interviews about the future-proofing aspects of the work with an analysis of our original notes and grant proposals. To position the current study with the two prior studies, both teams convened in January 2023 to plan it. The authors then began engaging in trioethnographic discussions through weekly meetings starting in March 2023 and conducted interviews with community partners starting May 2023. Data collection and analysis for this study did not overlap with the initial studies as detailed in prior work for Tech Help Desk [52] and Community Tech Workers [44, 45]. In this paper, we analyze and present data collected in this current trioethnography.

4.1 Data Collection and Analysis

Our interviews with each other and subsequent discussions consisted of our collective experiences discussing the sustainability aspects of our work. Discussions and interviews within and across teams took place from January through July 2023. Twelve meetings between the three lead researchers took place biweekly or weekly, with more frequently occurring meetings throughout May and July 2023 as we circled in on the emergent themes. For the Tech Help Desk team, 14 meetings occurred to discuss "what's next" with Tech Help Desk between January and May 2023; three of these discussions were formally recorded and transcribed. The meetings that were not recorded were more informal, and the Tech Help Desk team took notes in a shared document to record all ideas and concerns that arose regarding sustaining Tech Help Desk. For Community Tech Workers, the team met 22 times between January and July 2023 to discuss project progress and plans for the future. Detailed notes were taken at each of these meetings in which the team discussed questions about staffing changes, external funding, and grant writing. One of the Co-PIs on this project also

interviewed the community organization partner for an in-depth discussion on sustainability and the reflections on the community-university relationship. Both academic partners and community partners generated interview protocols.

Questions included those related to the technical-capacity programs and how they evolved, as well as how the academic and community partnerships that the tech programs stemmed from unfolded. Questions were generated by both academic and community partners. They were meant to elicit reflections on what worked well and what did not work well in terms of program formation and sustainability. For instance, how has the [Community Center]'s capacity changed since [Program Name] started? What kinds of trust earning and building were required (over the long term) for the [Program name] to be successful? What are the features of [Community Center] and [University partner] that make it possible for a constructive community-academic partnership? How were academic partners held accountable or not held accountable? The questions asked to each team member differed based on their role with Tech Help Desk and Community Tech Workers.

In all, the participants involved were the three lead academic researchers, two team members who were the director of business services at both Jefferson East, Inc. and Community Forge, and the executive director and board member of Community Forge. The senior leadership at Jefferson East, Inc. was not involved in this research collaboration and, therefore, was not interviewed for this analysis; this was partly due to the structure of Jefferson East, Inc., a larger and more established nonprofit than Community Forge. The data for this study included meeting notes from within and across both team meetings, transcribed interviews and analytic memos (about 250 words) with four members of the Tech Help Desk and Community Tech Workers teams, and the technical problems addressed with both programs over the multi-year studies as published in prior work [44, 45, 52].

The three lead researchers triangulated these data to identify cross-cutting themes through thematic analysis [14, 71]. Initial themes from the early meetings among the three lead researchers included geography, mobility and transportation, nonprofit budget capacity, academic funding models, institutional relations, histories, barriers, and more. Compiling these data alongside interview findings helped to streamline themes into three categories of sustainability: relational (i.e., sustaining and transferring trust between academic and community partners and entrepreneurs, setting and managing collectively established expectations), economic (i.e., maintaining a source of funds and alternative models of value), and technological (i.e., ensuring technical relevance of support, while pushing back against technological use which would be harder to maintain). Our community partners, both co-authors of this work, reviewed interpretations of the data, which also served as a form of member-checking [75]. We compared our findings with prior research in sustainability and future-proofing related to relational, economic, and technological sustainability. Before turning to our findings, as Howell *et al.* shared, we note that the process of writing this paper was a critical step in our data interpretation and dissemination, further pulling from autoethnographic approaches [32]. With community partners as co-authors, the voice of the findings is not solely the academic voice; this multi-stakeholder perspective of the findings is critical to sustainability issues. All quotes presented in the findings were from interviews with community partner representatives.

5 FINDINGS

In this section, we animate the three key themes for sustaining small-scale technical capacity building with respect to supportive and unsupportive practices within academic-community partnerships: relational sustainability (i.e., transferring trust across providers, expectation setting with community partners and entrepreneurs, overseeing and teaching practices of care, building on existing connections between institutions), economic sustainability (i.e., allocating funds for community personnel and resources from the beginning, flexibility in re-framing interventions to stay

in alignment with evolving community objectives and funding requirements, helping communities collect data for internal purposes to be able to garner more funding), and technological sustainability (i.e., contextualized guidance on tech investments, training tech use rather than just providing answers).

5.1 Relational sustainability

In this section, we discuss the behind-the-scenes work to foster long-term relationships between the academic and community partners, as well as between providers (i.e. individuals who were working directly with entrepreneurs to provide tech support) and entrepreneurs. We distinguish between the academic and community partners to contribute to current research opportunities and need to expand upon the nature and dynamics of such relationships throughout the project's lifetime. While prior work highlights approaches to foster initial trust to start relationships between academic and community partners [55], our work continues this conversation to examine how relationships grow and change over time.

5.1.1 Relational Sustainability Between Community and Academic Partners.

Tech Help Desk at Community Forge Le Dantec and Fox detailed the work required of academic partners to build meaningful relationships with local community spaces, co-articulate research agendas for mutual benefit, and begin the process of establishing rapport [55]. Through candid conversations between those involved in Tech Help Desk at Community Forge and Carnegie Mellon University, we uncovered details of how these relationships between academic and community partners were nurtured and tended to over the long term. Particularly, Community Forge leadership reflected on prior academic partnerships, which led to community burnout or extractive practices. They discussed how things are done differently with Tech Help Desk, in part due to the clarified relational elements of the collaboration.

> "And then [the academic partner] just jets out of the project once [the] research is done...[the community partner is] left wishing and hoping like, 'Wait a second, I partnered with you because I thought you were gonna help me get resources or…put more into this program that we're struggling to resource."'

Here, the Executive Director of Community Forge described the tendency for academic partners to leave projects and not fulfill their commitments. He goes on to say that if academic partners do "jump in and jump out," then they "imprint on [community members] the idea of, 'Oh, I'm in the have-nots! That was the haves. And look at how they move. They don't care about us'...[They] might have just reinforced disinvestment and racism through a quick in and out project." The Community Forge Executive Director described prior academic partners who have left on non-agreed-upon terms due to a combination of poor expectation management and neglect. As a result, these academic partners reaffirmed notions of inequity, disinvestment, and racism by sending the message to community members that they are "in the have-nots!" Academic partners then bring and take whatever resources along with them, in addition to any data collected. In these discussions, it became clear how it is important to remember that the method for transitioning out can create harm if not properly planned and executed.

Instead, building relationships that last over long periods between academic and community partners meant that the relationship was always being evaluated by community partners to determine if academic commitments to the community were authentic and whether there was mutual trust:

> "It is only as useful to the community as [academic partners] are willing to make authentic real relationships...And do I apply more trust to you, [name of interviewee]?

> [You are] someone I've known for years...We've made certain commitments to each other. We've like evaluated whether we stick to our commitments and all this kind of stuff. I have a lot more trust in you than an arbitrary entity. . . If I have that individual relationship and I [know that] you won't screw me over now. We're in a place of, like, you care about me, and I think that's where all good relationships have to start."

It was important that individual relationships, in addition to institutional-level relationships [21], were established between academic stakeholders and community stakeholders, which were formed based on commitment follow-through and repeated evaluations over the years.

During the running of Tech Help Desk, the Community Forge Executive Director became faculty at Carnegie Mellon University. In addition, the main principal investigator of the research project (faculty at Carnegie Mellon University), joined the board at Community Forge. This came up during interviews where interviewees reflected on how this affected the relational aspects of the collaboration over the long term. The Carnegie Mellon University faculty and Community Forge board member discussed how being on the board (which he was invited to join by Community Forge leadership) provided a mechanism of awareness as to what was happening in the community space. Conversely, the Community Forge director who became a Carnegie Mellon University faculty member ensured that he was deeply aware of what incentives drove academic partners and how to look for where incentive structures may be unaligned. These dual affiliations were important to showcasing commitment to the community partner and better-managing expectations over the long term.

Community Tech Workers at Jefferson East, Inc. Unlike Carnegie Mellon University, University of Michigan was a one-hour drive away from the community partner, which introduced additional concerns about whether the university team would understand the local context. Like many universities, University of Michigan has a history of problematic community engagements, such as not following through on project goals and not contributing local value in return for community data. For these reasons, establishing trust with potential partners for this project was developed over several years prior to engagement. One of the university constituents had been providing free financial services in Detroit for seven years, so an initial relationship had already been established when the university partner put out a call for a partner on this grant. Furthermore, similar to Tech Help Desk, our community partner contact was affiliated with the partner university; in this case, he was a University of Michigan alumnus who expressed that graduating from University of Michigan gave him an initial understanding of university-community partnerships and the general research process. Still, despite this initial level of awareness, the community partner was still wary of potential pitfalls:

> "The reputation is that universities or colleges are only interested in what benefits them and not necessarily what benefits the community. And if you're put in a situation where that's true, it could create an extractive environment. It could create a situation where we're not actually benefiting the people who we're supposed to, which is why, in the beginning of this whole process, I was very leery. And I put my foot down quite a bit and said, 'We want to make sure that these businesses get what they're supposed to get out of this.' "

He expressed that certain early signals helped him build trust with the university partners. In certain university-community partner relationships, the partner is expected to enact a program while the researcher simply "evaluates." In contrast, given our community-based approach, it was critical that the university team also play a significant role in program implementation, which signaled to the partner that the university team was invested:

> "There was an energy like, I want to be there... [The training] wasn't something that was pawned off on me. It was like, we are going to do this. And if there was a time where I couldn't do something, I feel secure that the larger team was going to step in and make sure it happened. So, that happened very early on."

The university team met with the community partner weekly to exchange updates and collaboratively brainstorm solutions to issues that came up. For instance, when a provider dropped out, we pooled our networks together to find a replacement. The university team also worked closely with the community partner to regularly apply for grants to continue funding the program. Most importantly, they regularly discussed with the community partner to ensure that the collected research data would also be useful for the community partner. For example, in an initial survey with local small businesses, they ensured that the findings would inform the design of the Community Tech Workers program and could be used by the community partner for public-facing reports and future grants.

The community partner expressed that in prior engagements with academia, the researchers would often extract data without sharing or only collect data useful for publications but not particularly informative for the community. In the Community Tech Workers case, the community partner expressed that they appreciated how the survey to local business owners helped directly inform how the Community Tech Workers program was designed.

5.1.2 Relational sustainability between entrepreneurs and providers.

Tech Help Desk at Community Forge During the interview with the Executive Director of Community Forge, he distilled that the success of Tech Help Desk over the long term was attributed to the relationships Community Forge had built with local entrepreneurs, and from there, how providers have continued to build on this foundation:

> "Tech Help Desk needs to be embedded in this trust situation. We're the people who are actually on the ground forming the relationships, [and entrepreneurs] need to have the relationship with the people that are also providing the tech support. That's been key to the whole thing because it allows the pipeline of people. It creates the context of trust."

Here, the Executive Director emphasized Community Forge was primarily doing the work to build relationships with the community. Critical to the success of Tech Help Desk was a mutual acknowledgment by both academic and community partners that the community partners' groundwork of community engagement day in and day out laid the critical foundation for the project. From this foundation and mutual understanding, as the Executive Director discussed, came the opportunity for Carnegie Mellon University volunteer providers and entrepreneurs to build relationships over time. When an entrepreneur expressed interest in working with Tech Help Desk, they were partnered with a provider with the intention that they would continue to work with the same provider over the long term. This pairing over the long term was essential for providers and entrepreneurs to get to know each other better, ensuring that information flow was both ways, as reciprocal self-disclosure is important for trust building [55].

Since providers were volunteers for Tech Help Desk, proving commitment was critical. This, therefore, made it important to have heightened attentiveness to the follow-through of and transitions between providers. There were three occasions when providers would change. First, entrepreneurs would work with a different provider with more expertise in their sought-after tasks. When these transitions between providers occurred, they were done with clear communication and entrepreneurs' informed consent. Another instance of provider change was more sudden: when a provider could not make an appointment due to a scheduling conflict, sickness, travel, etc. In this

case, the entrepreneur was emailed an explanation from the central Tech Help Desk email. Finally, a third time a provider would change was when a provider could no longer volunteer because they were leaving (graduating, moving away). Expectations with providers were set so they knew a commitment to Tech Help Desk was a long-term commitment (and not just one semester and done). These departure dates (e.g., graduation dates) were known several months to a year in advance. They were communicated to community partners so that plans could be made collectively with ample time to respond to evolving needs and concerns.

Community Forge leadership tracked and vetted Tech Help Desk provider performance as they worked with entrepreneurs. In the early days of Tech Help Desk, when there was primarily one provider, the Community Forge Executive Director would ask entrepreneurs who had worked with them what their thoughts were to ensure they were providing effective support—making sure that entrepreneurs felt good about the session. In addition, Tech Help Desk hours on Wednesdays occurred during Community Forge staff meetings, so all Community Forge staff was in-person in the building at the same time as two of three providers. After the meeting, many from Community Forge leadership would work in the main area where Tech Help Desk took place. This was essential for Community Forge leadership and staff to observe sessions and provide feedback or guidance when needed. This also gave Community Forge staff an ambient awareness of how Tech Help Desk as a service was doing overall (i.e., how many and which entrepreneurs used the services).

Community Tech Workers at Jefferson East, Inc. Like Tech Help Desk, Jefferson East, Inc. also emphasized that trust between the entrepreneurs and providers was critical for the program's success. Therefore, much of the leadership team's time went into training the providers on how to interact with people from the local community, especially those who were not from the neighborhood. The Director of Business Services at Jefferson East, Inc. described how providers representing the nonprofit had to learn how to speak with entrepreneurs and understand their unique business context and needs:

> "I also witnessed a lot of people [from University of Michigan] who felt like they were more important than other people. And I didn't want our businesses to get that experience…We did a lot of modeling because I needed them to see that the person that they're talking to, is not a professor, the person that you're talking to is someone who's really good at baking muffins. And that's what they know…so much of our time in the training was built around customer care."

The project team also supplemented this training with local neighborhood tours by local experts who knew its history, fulfilling suggestions to understand the historical context as suggested in prior community-based research [41]. Fostering this appreciation and understanding of the local culture was critical for building relationships between providers and entrepreneurs and fostering greater commitment to the local neighborhood.

Providers from the community already enjoyed an initial amount of trust from entrepreneurs, given that they were from the community. For example, in the tech support sessions, entrepreneurs would call out personal connections, like knowing the provider's parents. This helped build connections between the providers and entrepreneurs early on by enacting mutual care. In situations where a provider from the local community and a provider from the university were paired together, university providers expressed learning to "step back" and allow the local provider to build the relationship with the entrepreneur, given their contextual connections and knowledge.

Additional impacts on trust included having the tech support services housed in the local community center known by locals. This meant that entrepreneurs could walk in the door any time and ask questions or set up a meeting. The community partner lead contact used these local

relationships to regularly check in with entrepreneurs in person to assess the efficacy of the program and further strengthen relationships with entrepreneurs:

> "Some of the businesses that I personally knew, I would ask them, 'how was your experience?' I know you worked with this [provider], what was your experience? And it was really important to me to hear that they had a good experience. Every [provider] we had I asked one of their [entrepreneurs]... One of them I literally met him outside of his business. I pulled him to the side and said, 'how are things going?"'

Similar to Tech Help Desk, the community partner leadership was able to observe and check on provider-entrepreneur relationships regularly because the service was occurring in their local community center. The community partner also ingrained a care-based approach in the providers by encouraging them to listen to entrepreneurs' challenges, affirm their needs, and recommend new skills for them to learn. With this approach, entrepreneurs were more comfortable approaching providers for help.

5.2 Economic Sustainability

This section focuses on how Tech Help Desk and Community Tech Workers were financially sustained across multiple years. In doing so, we compare how the two models compared in terms of their funding and budgets. We reflect on each case to identify lessons for building a service that is in itself economically viable.

Tech Help Desk at Community Forge To provide technical support, Tech Help Desk recruited volunteer providers from the partner university, Carnegie Mellon University. Initially, this decision was made because of the need for tech support immediately within Community Forge. In 2019, when Tech Help Desk started, Community Forge had few full-time staff who shouldered all of the tech support for tenants and entrepreneurs in the space. Over time, Community Forge grew to nine full-time staff members, increasing the center's overall capacity. As the Executive Director shared, this increased capacity would soon make it possible for Tech Help Desk to be managed by a Community Forge staff person, and ultimately more effectively integrating the service within the organization: "[We are working towards] having an allocated person at Community Forge to make sure there are [providers], there is a process." And while this shift of ownership of Tech Help Desk—from being run by the lead volunteer towards being run by a Community Forge staff—is essential for the longevity of the service, this shift came with financial implications. For instance, the director continued to share:

> "Tech Help Desk doesn't work if there is not a steady supply of labor or money. I'm not trying to be overly capitalist...if we train Community Forge staff, we need the money to pay them."

Here, the Executive Director grappled with the increased costs of incorporating Community Forge staff into Tech Help Desk (along with university volunteers). For instance, training staff to become providers (as with the Community Tech Workers model) would mean raising additional funds to provide fair compensation. Through our conversations, he reasoned that volunteer effort might be a more cost-effective solution if the community center or academic partners did not have these funds.

Through these comparative remarks between the Tech Help Desk and Community Tech Workers model, the Community Forge Executive Director reasoned that, regardless of the model of tech support, it was critical to ensure that tech support was free or highly affordable:

> "If [entrepreneurs are] not getting the service for free or subsidized, then they're gonna be like, 'this is less attractive to come here because I was coming here to offset my costs."'

Ultimately, for Community Forge, a steady supply of dedicated volunteers was the ideal way to sustain Tech Help Desk while ensuring the service was affordable with the currently available resources. The direct costs for Tech Help Desk included $200 per month for membership to Community Forge, and approximately 34 hours of volunteer effort per month (See the Appendix A for comparison of direct costs across case studies). Tech Help Desk providers were supported financially through their academic positions at Carnegie Mellon University, enabling them to volunteer for two to three hours each week. Federal funds covered the costs of Community Forge membership, participant costs, and community collaborator compensation. This worked for the most part until the Tech Help Desk team decided to move into an office (rather than just working out of the shared meeting space in the building), and the federal funds would not cover this cost. As an immediate solution, the Carnegie Mellon University PI provided personal funds to bridge this gap: *"I'll pay for now, and then we'll figure it out. But we never figured it out. And It was fine. It was like a donation to Community Forge"*. Ultimately, "figuring it out" (or finding another way to cover costs without using personal funds) did not happen, but with COVID-19 the Tech Help Desk team decided to move out of the office and return to the shared space when the lockdowns ended. When Tech Help Desk rented an office to host tech support sessions and have a dedicated space, this cost an additional $1,000 per month.

In addition to the cost-effectiveness of recruiting volunteer providers at Carnegie Mellon University was that the carefully selected providers who have participated over the years (one faculty member, two post-docs, and three PhD students), had proven their commitment to Community Forge's mission and values over time. In addition, as the Community Forge's Director of Business Services pointed out, having affiliation with Carnegie Mellon University was helpful to add to the brand of Tech Help Desk.

Community Tech Workers at Jefferson East, Inc. Free technical support is most viable for under-resourced businesses, but financing such a program relies on a steady funding source, often from grants, foundations, or government sources. While volunteers are a more affordable option for sustaining free tech support, it was critical for our community partner that some providers be paid employees from the local community as a form of community capacity building. Jefferson East, Inc. leadership understood that hiring local people would ultimately be more costly and require significant training, but they emphasized the importance of locals empowering themselves:

> "There's been a lot of talk about Detroit being the next Tech Hub. And my fear is that it'll be that by other people coming in and making it that instead of leveraging the people that we have, and then a lot of us will get displaced. So yeah, all that to say, we need a financial model that will allow us to keep [local providers] on staff."

Jefferson East, Inc. leadership acknowledged that hiring local workers who have not held a job in technology, or a full-time job at all, was a risk. But, the community organization and university team were willing to put in the time, as well as had the funds from a foundation grant, to train providers to meet the community organization's expectations. The hope was that local providers would stay in the job "long enough to get work experience and certification" that could help them transition into higher-level jobs in technology or provide them with the experience to start their own businesses. Following a train-the-trainer model, the existing providers were also able to help onboard new providers and shorten the onboarding process.

While the community organization would like to continue providing free support to attract entrepreneurs who might not have the finances to pay, they acknowledged that entrepreneurs would be more likely to show up for meetings if there were some financial commitment:

> "...team members were complaining that business owners weren't showing up for their appointments. If they had paid for that appointment, there's a lot more likely that they

> would have shown up or called and said, I'm not coming. Maybe there's a sliding scale for based on the revenue that they have. But, I think they take it more seriously when they have to pay for it."

The tech support providers explained that sometimes clients would not show up because there was no penalty for missed appointments. The community organization and university team have had many conversations debating the pros and cons of charging a nominal fee to entrepreneurs to encourage meeting attendance. Ultimately, determining a sustainable and inclusive pricing structure would take significant research to determine and is not an idea that has yet been dismissed. For now, the community organization has decided to continue searching for funding to keep the program free, which requires finding significant funding sources, considering the program employs providers full-time.

Originally, the grant proposal suggested hiring local providers on a part-time basis. But, we quickly learned that offering full-time work was more inclusive because it allowed providers to focus entirely on the Community Tech Workers position rather than juggling multiple jobs to meet a livable salary. At the time of hire, the local providers worked part-time jobs at local manufacturing plants and fast-food restaurants at odd hours. Therefore, the goal of the initial foundation grant was to demonstrate the value of the Community Tech Workers model of full-time employees to drum up additional funding commitments from local organizations interested in supporting entrepreneurship and business development. As of writing, three organizations have committed a total of $128,100k for the next year. However, funding such a program is still much more expensive because it requires paying for the full-time labor of several employees and a manager. Thus, our estimated full cost to run Community Tech Workers for a year is $350K (See Table 3 for a detailed side-by-side comparison of the direct costs of both programs).

5.3 Technology Sustainability

In this last section, we focus on technological sustainability, which focuses on fostering responsible engagement with technology: allocating time and support for learning maintenance and repair (i.e., training tech use rather than just providing answers), strategic planning with current resources (i.e., contextualized guidance on which technologies are better investments), and pushing back on technocultures which inspire adoption of high-tech yet low-utility tools. Second, we build on the literature on community-based research to develop sustainable (and unsustainable) practices to support community-centered academic partnerships over the long term. From our engagements with entrepreneurs throughout both programs (six years collectively), we have repeatedly witnessed entrepreneurs and providers navigate pressures to be "high tech" or adopt the latest technologies marketed to them. In addition, in the context of community-based research, computing research funds often encourage adopting the latest technologies (especially when funds come from tech companies). As a result, computing research funds are less likely to be intended for technological maintenance purposes.

Tech Help Desk at Community Forge Tech Help Desk provides broad computing support ranging from setting up eCommerce websites, organizing digital files, clearing hard drives, effective typing skills, setting up printers, etc. With Tech Help Desk, we have found that there are certain kinds of technology that entrepreneurs need to have set up (i.e., some online presence, digital file management, or communication technology). However, certain technologies are less essential despite them being marketed as such by large tech companies. Such technologies include an online presence on every social media platform, Google Business pages, flashy business websites, and so on.

Tech Help Desk played a critical role in discerning with entrepreneurs which technologies were worth their investment and which technologies may be more show than tell. Tech Help Desk providers did so by actively listening to entrepreneurs' needs and collectively strategizing how to approach technology adoption in a way that worked for their budget and time. For instance, when entrepreneurs sought support to create their business website, initial discussions with providers stayed high-level and strategic, understanding the available budget, time, interest, and long-term vision for the website. All the while, providers were on the lookout for more cost-effective solutions, ensuring entrepreneurs had ownership over their technologies (e.g., owning their domain outright rather than through a third-party provider like Wix) for entrepreneurs to be in control of their technologies over the long term. In this way, guidance needed to be contextualized on which technologies are better investments and to push back on technocultures that inspired the adoption of high-tech, yet low-utility, tools. To further foster sustainability of strategic decisions providers and entrepreneurs made collectively, providers would set the expectations that Tech Help Desk was not a free consulting service. Instead, providers had to set the expectations that Tech Help Desk provided a side-by-side model of support, working with the entrepreneur as they worked to address their computing needs. In addition, providers took detailed notes of all meetings with entrepreneurs to share with the entrepreneurs: why they made certain decisions to adopt some technologies but not others, keeping track of progress made, questions for the next meeting, and so on.

On the other hand, it was also important that providers had the needed technical know-how of the latest technologies to provide effective support. This was especially challenging in a rapidly moving computing landscape, and ensuring providers had up-to-date knowledge required constant check-ins. For the digital resources provided alongside Tech Help Desk (for instance, a webpage of ChatGPT prompts for entrepreneurs to try out, how-to videos for setting up websites and other business software, etc.), these resources needed to be assessed annually to remove any deprecated content (e.g., interfaces quickly evolve rendering how-to videos with screen recordings ineffective).

Community Tech Workers at Jefferson East, Inc. Digital engagement among local businesses was a key interest for the community partner, given their recent investment in developing a local tech hub with nine computers. They felt upgrading local businesses' technology would ultimately attract more customers and greater financial investment into the neighborhood. For instance, they emphasized early on that many businesses in the area did not have an online presence, and if they did, they had incorrect hours or information. While Jefferson East, Inc. believed that digital engagement was critical to local business growth, they recognized that many businesses did not have the time or expertise to adopt technology cost-effectively.

Through observations of provider-entrepreneur meetings, we saw examples of entrepreneurs paying someone, receiving volunteer support, or going through a program to get to the first stage of technology use but then not knowing how to maintain it. For example, one up-and-coming restaurant business was targeted by a company to receive a free website design as part of its community development initiatives. A designer hired by the company built a basic website but never showed the restaurant owner how to edit items on the page, such as photos or general information, like hours and menu items. When the restaurant owners asked the Community Tech Workers providers for help updating the website, they collectively determined that it was easier to re-make the website on a user-friendly platform (i.e., Wix, WordPress) rather than learn the backend code provided by the original web designer. In other cases, entrepreneurs described hiring someone to install expensive technologies in their store only to discover that each additional minor update would cost hundreds of dollars. In some of these situations, it was not clear whether entrepreneurs would have fared better off using offline and paper-based tools to achieve the same goals.

A core principle of the Community Tech Workers program was that providers would need to teach entrepreneurs how to address the problem on their own. This meant that providers had to explain early on that their role was to *teach* business owners how to use technology rather than have them fix the same problem every time it came up. While business owners hesitated to invest this time to learn initially, they ultimately appreciated knowing the skills, which helped them build confidence in their digital ability. In follow-up conversations, business owners have expressed their newfound confidence and awareness of technology, which has been significantly useful for their day-to-day work. Furthermore, providers were particularly useful in helping entrepreneurs overcome the upfront cost of technology adoption, specifically by researching which technologies were appropriate and cost-effective for each particular business. In this way, providers were able to scaffold the process of technology adoption, allowing entrepreneurs to focus on skills most relevant to them.

6 DISCUSSION

The shared goals between Tech Help Desk and Community Tech Workers gave the authors a rare and unique opportunity to compare observations of tech support programs across two post-industrial cities. While the program models were distinct (See Table 1), they both uncovered similar challenges around program sustainability for small-scale tech capacity building. Through a comparative analysis and retrospective ethnography across these two case studies, we identified three key opportunities considering sustainability in community-based research: relational, economic, and technological. While other themes may emerge from different community-based projects, we highlight these three as the most prominent to emerge from our context of implementing community-based research programs for supporting digital engagement among local entrepreneurs and small business owners.

In reflecting on these three facets of sustainability, we repeatedly came to the question, "What comes next?" In the case of Tech Help Desk, should Community Forge expect an eternal flow of Carnegie Mellon University students to serve as volunteers? In the case of Community Tech Workers, should Jefferson East, Inc. be expected to partner with University of Michigan indefinitely on the implementation of the program? In conversations between ourselves and the broader project teams, we agreed on the ultimate goal to sustain the benefit to the community, in this case, tech support for local businesses. But what that looked like and how that happened was subject to change. Drawing from related literature in community organizing [4, 60], we pushed ourselves to rethink how plans for sustainability could be more flexible. Therefore, in this section, we draw on the concept and literature of "future-proofing" as one opportunity to rethink longevity, and we end with a discussion on whether longevity should be the end goal [73].

6.1 Future-Proofing as a Pathway to Longevity

Prior work in community-based research in HCI suggests future-proofing as a potential approach to fostering sustainability. Future-proofing is a proactive approach to incorporating strategies and measures to anticipate and mitigate future challenges, ensuring the longevity, relevance, and effectiveness of a system, project, or initiative [73]. By integrating forward-thinking strategies, such as anticipatory planning, capacity building, and adaptable frameworks, future-proofing enables community-based research projects to address emerging challenges and shift community needs. Ultimately, future-proofing enhances the impact and longevity of community-based research by mitigating the risk of research becoming outdated or disconnected from the community.

In doing so, future-proofing responds to recent calls for more long-term considerations in community-based approaches: "How could funding in HCI, and computing more broadly, support community engagement to conceptualize research projects, rather than specifying an outcome for

researchers to achieve from a project? How could publication processes encourage reporting focused on developing community members' skills in data analysis and technology development rather than the validity and reliability of experimental results?" [19, p. 12]. Our work starts to address these questions by outlining 1) how relationships between researchers and community organizations could be initiated, revisited, and sustained in a mutually respected manner (relational future-proofing), 2) how research funding could help kickstart community-based initiatives to convince engagement from future funders (economic future-proofing), and 3) how pressures of technology adoption should be tempered by the individual needs and resources of those using them long term (technological future-proofing) (see Table 2). We address these questions by contextualizing them within prior scholarship, demonstrating our contributions to the field, and bringing forward new opportunities for future work.

6.1.1 Relational Future-Proofing Through Continuous Expectation Setting. We explored future-proofing for relational sustainability on two levels: between providers and entrepreneurs and between the university research team and the partnering community organization.

Prior Work: Through our comparative case study, we uncovered insights that aligned with previous research on relationship building in community-based approaches in computing [50, 53, 55, 61]. Prior work emphasized the importance of *care*—the ongoing interactions within academic-community partnerships to promote community members' well-being and personal values [50, 61]—and *attachments*—the commitments and dependencies which are required between communities and co-created artifacts for successful infrastructuring [21]. In addition, at the onset, academic-community partnerships should prioritize understandings of local histories [41], as well as leverage design methods which facilitate co-learning, community making, and reflection [58].

Instantiation in Study Contexts: Across both programs, our research called attention to the critical role of care in establishing trust between providers and entrepreneurs. We uncovered the importance of engaging providers from the local community, structuring entrepreneur hand-offs between providers, constantly setting expectations as community goals evolved, and strengthening connections between the partnering academic institutions and community organizations through dual affiliations.

In both programs, engaging providers from the local community provided a shared context for tech support to thrive in ways outside volunteers must work to achieve over much longer periods (and may never actually achieve). While providers *from* the community made a significant impact on trust initially, we found that outside university volunteers, when trained to enact care, could provide an opportunity to break down silos between communities and the academy on a small scale. For Community Tech Workers, transfer of care practices was formalized through a train-the-trainer approach where senior providers onboarded new providers, introducing them to entrepreneurs and ultimately engaging them in the culture of the program and local neighborhood. This approach ensured providers were well-acquainted with local histories [41]. For Tech Help Desk, structured expectation setting was a key component of a relationship of care between providers and entrepreneurs. By giving entrepreneurs significant notice for when a tech provider might leave (i.e., graduate from school), structuring the hand-off process (e.g., by repeat introductions with a new provider, old provider, and entrepreneur), and detailed note-taking practices and open conversations with entrepreneurs, community partners were able to plan accordingly and establish trust. In this way, we found that constant expectation setting was a critical step in relational proofing.

Across both programs, we there were specific aspects of the academic-community partnerships which allowed for greater responsivity and relational future proofing. For instance, community

Table 2. Prior research informing our comparative case study related to the three emergent themes of sustaining community-based approaches in computing: relational, economic, and technological.

Suggestions from Prior Work	Instantiation in Study Contexts	Considerations for Future Work
Relational Sustainability		
• Care-based approaches [50, 61] • The importance of showing commitment and setting expectations [55] • Co-articulating goals, prioritizing attachments between communities and artifacts developed [21] • Understanding local histories [41]	• Trust building: Earning and transferring trust between volunteer providers; reserving opportunity to turn down new providers (Tech Help Desk) • Care transfer: Hiring local providers committed to community development (Community Tech Workers) • Expectation setting: Frequently revisit goals with community stakeholders to prioritize learning alongside task completion (both) • Training and oversight: From community leaders on how relationships are prioritized and managed (both) • Dual affiliations: Between community organization and university (both)	• How to transfer trust as team members and values change within academic-community partnerships over time • Building the community's connections to the university partner, and vice versa
Economic Sustainability		
• Grant writing with community partners [41, 77] • Facilitating community ownership [62]	• Rethinking academic funds: Researcher funding used as a kickstarter to community programming (both) • Strategic funding (both): – Flexibility with changing community goals and funding criteria – Research involves collecting data for community internal purposes that help garner more funding – Alignment with strategic vision • Mutual Authorship (both)	• Alternative monetary sources for programs outside of grant funding (e.g., sliding scale or refundable deposit for tech support services) • Alternative models to support programs other than financial funding (e.g., bartering)
Technological Sustainability		
• Infrastructuring publics as a way to formalize support [23] • Choose technologies that are easier to maintain at the get-go [53]	• Infrastructuring Publics: – Train-the-trainer models (Community Tech Workers) – Local university volunteers with tech expertise and pedagogy training (Tech Help Desk) – Teaching technology use rather than just providing answers (both) • Critical Discussions: Equip community partners with discernment to avoid tech-creep; detailed note-taking for paper trail of decision making (both)	• Reconsidering when tech advancements are appropriate

partners from both Community Tech Workers and Tech Help Desk had affiliations with the university (or became affiliated over the course of the partnership): Community Forge Executive Director became faculty at Carnegie Mellon University (although in a different department than the Carnegie Mellon University PI); the Jefferson East, Inc. Director of Business Services had previously obtained his master's at University of Michigan; the Carnegie Mellon University principal investigator was one of 10 board members at Community Forge. This dual-affiliation was helpful for community partners to know what to look for and what to look *out* for. In other words, because of the experience that leadership at both community centers had within academia, they developed techniques for quickly discerning the authenticity of academic partners through repeat vetting. This dual affiliation of both leaders with each institution provided an intertwined structure to foster follow-through and showcase commitment. However, such dual affiliations are not always possible in academic-community partnerships. Regardless of a dual-affiliation or not, both the university researchers and community partners must engage in mutual expectation setting upfront regarding what effort and resources each can provide. As the community partner at Jefferson East, Inc. expressed, having University of Michigan carry out their promised commitments early on was key to strengthening the relationship.

Considerations for Future Work: Looking ahead, our research suggests potential areas for further investigation, including exploring the relationships among team members over time, given the transfer of trust needed among new team members and stakeholders. Ways to build a community's prior connections to the university and vice versa are also worth considering and necessary for mutual expectation setting and strengthening relationships. In addition, given the histories of neglect, erasure, and ongoing unfilled promises between academic and community partners, it is critical to implement mechanisms for academic accountability over the long term.

6.1.2 Economic Future-Proofing Through Kick-starting Initiatives. In this section, we explore economic sustainability as an emergent theme necessary for future-proofing community-based approaches in computing.

Prior Work: With a few exceptions [39, 41, 62], HCI studies rarely discuss approaches to future-proofing programs in terms of their budget (although this is a key issue across most research projects, regardless of domain). For example, Hanseth and Aanstad suggested using pilot programs as a way of "enrolling the first users and then drawing upon the existing base of users and technology as a resource to extend the network" in order to grow a customer base [39, p. 386], while Merkel *et al.* suggested working towards community ownership for financial sustainability [62]. In addition, prior community-based research discussed how academic partners could facilitate internal grant writing with community partners to help raise funds over the long term [41].

Instantiation in Study Contexts In our two programs, we reframed the conventional role of academic funds in community collaborations to be a vehicle for kickstarting funding rather than an end-all-be-all. For both Tech Help Desk and Community Tech Workers, there was a need for a constant supply of funding to keep the service free. These programs were financially supported over the last several years (and ongoing) through a combination of federal and local foundation funds. In considering ways to use current funds to secure future funds later on and better future-proof community collaborations, we suggest making strategic decisions early in the grant writing process. As we navigated this process, we observed several shifts that have needed to occur to actualize this idea. For example, securing funds for a community coordinator and building a promotional website and marketing for the tech support programs (e.g., https://forge.community/services/tech-help-desk) would better set up these programs to receive additional funding in the future. Ultimately, we inquire whether we have set community partners up to receive grant funds in the future and

potentially on their own, such as by facilitating internal data collection for community partners to use for additional grant raising. In this way, we view these community-based research efforts as using academic funds to kick-start community initiatives. As researchers, two additional options include investigating different price models that might help self-sustain the programs over time outside of grant funding (e.g., identifying key price points if needed, future partnerships with other entities, etc.) and exploring alternative models to financial funding [27] like bartering services among entities.

Further, our research underscored the importance of aligning tech support programs to the ongoing and new programming within partnering community organizations and their evolving goals. Aligning with their strategic vision contributed to the understanding of long-term collaboration, which required constant communication and collaboratively working together to see what needs to change. For example, Jefferson East, Inc.'s goals were often closely aligned with how funding flowed into the city. However, the goals of these funding sources (e.g., reducing crime) did not always directly align with the initial goals of the project (local business development). In reaction, the team reframed the project goals to meet the community organization's shifting visions to align with potential funding sources. For Tech Help Desk, when Community Forge launched the Business Service Center and monthly entrepreneurial networking events, the Tech Help Desk team discussed how to better intertwine Tech Help Desk goals and services with these new services; these conversations carried on for months as the programs evolved and staff grew.

In addition, by having Community Forge and Jefferson East, Inc. leadership as published authors at top-tier conferences, this supported internal grant fundraising because community partners could reference the peer-reviewed empirical work to show the efficacy of their programming, as well as to show that they were equally involved. At both Community Forge and Jefferson East, Inc., community stakeholders were interested in being more involved in the research process by co-authoring related publications, as this was aligned with their career goals and the fundraising goals of the community centers.

Finally, considering different program funding models continues to be an ongoing conversation in both programs. For Jefferson East, Inc., considering an alternative source of revenue was primarily motivated by the need to encourage entrepreneurs to show up at scheduled meetings. Not following through was costly to Community Tech Workers, as this was time that providers could have invested elsewhere. On the other hand, it was important to be compassionate towards the demanding and unpredictable nature of entrepreneurship. For Tech Help Desk, instead of charging a small fee as Jefferson East, Inc., the team considered having entrepreneurs pay a refundable deposit to secure an appointment. If the entrepreneur did not show up, these funds would be put towards Community Forge's programming.

Considerations for Future Work: Paving the way for future investigations, we suggest the following concrete opportunities for kickstarting community-based projects: budgeting for key community organization personnel and resources, aligning with the strategic vision of the community organization, scaffolding academic credentialing (i.e., authoring papers) to facilitate future grants, and using research projects to explore alternative funding models. While many grants are already designated specifically for pilot projects, our findings emphasize that future-proofing requires thinking through these questions ahead of time so that we set expectations early. Funding program managers often facilitated future-proofing by prompting reflections on risks to participants. In our work, we found that, in addition to risk, it was important to mutually acknowledge the openness to multiple approaches for arriving at shifting goals.

6.1.3 Technological Future-Proofing Through Responsible Adoption. Technological future-proofing emerged by training personnel to provide technical support alongside interventions, and prioritizing practical advice that resisted short-term trends.

Prior Work: This study contributes to the growing scholarship on infrastructures related to technology support and capacity building in local communities. Specifically, we respond to calls in HCI for infrastructuring publics to formalize support [23]. This work also aligns with prior HCI work on repair, which highlights the importance of making time to negotiate what things are worthy of investment and repair [69], and to remember that the most advanced technologies was not always appropriate for longer-term solutions [53]. Such considerations are especially important in the context of working in "lean economies," where citizens have limited time and resources [26, 44].

Instantiation in Study Contexts: The creation of both programs added to the infrastructures of tech support and technical capacity building in the local community by providing a designated source of guidance for responsible tech engagement. Our findings suggest a three-pronged approach. First, providers and entrepreneurs should ideally engage in back-and-forth critical discussions about which technologies are essential vs. when technologies are "nice to have." To do so required providers to not only fine-tune their listening skills alongside their tech know-how but also to constantly be in conversation with themselves about the techno-heroic culture they may carry with them due to their technical training. A guiding principle for these reflections was that running a business without technology is hard enough, but the addition of using technology is not always going to make everything easier.

Second, future-proofing tech support also meant allocating time to support the maintenance of technologies and making time for repair and refreshers. In our study contexts, if an entrepreneur had not been to Tech Help Desk in several months, often their first visit upon return would primarily be a refresher on what was covered in their prior sessions. It was important to value these kinds of sessions alongside more technically "novel" upgrades. Further, future-proofing required Tech Help Desk and Community Tech Workers providers to step away from doing tasks *for* entrepreneurs, but instead doing tasks *alongside* entrepreneurs. In doing so, entrepreneurs increased their capacity to maintain technologies themselves, rather than needing to pay money and wait on someone else to address their tech needs. Sometimes, though, entrepreneurs were confused or upset that providers were unwilling to do the technology work for them. In these cases, paying for a technology consultant (i.e., a graphic designer) was more appropriate if entrepreneurs did not have the time but did have the funds to maintain and adopt technologies themselves. Over time, however, with the relational commitments described in prior sections, most entrepreneurs came around to seeing the value of learning the tools to overcome gaps in tech support.

Considerations for Future Work: In considering future investigations, it would be worthwhile to better understand entrepreneurs' perceptions of having technology work done together versus having someone do it for them or having them do it themselves and how such models impact their businesses going forward.

6.2 Rethinking Longevity in Community-Based Research

In light of our conversation on future-proofing, our goal is to open the conversation around rethinking longevity in community-based research. It is important to note that similar conversations are unfolding across disciplines outside of HCI, such as information-communication technologies (ICT) for development. For instance, Vallance *et al.* unpacked what "social sustainability" means, defining it as meeting basic human needs, physical environmental goals, and maintenance [80]. Ali and Bailur argued that the very notion of sustainability within ICT for development is an unrealistic

concept because it is difficult to operationalize [4]. Instead, they argue that the development literature must be open to a kind of bricolage and improvisation. These parallel threads of scholarship can provide clues for how to rethink longevity in community-based research in computing. While it is impossible to anticipate all of the twists and turns of community-based research [53], we hope that these lessons will help other academic-community partners more actively anticipate ways to sustain their work over the years.

To start, learning to be flexible in community-based research can be challenging [65]. At a baseline, both partners enter the project committed to the outcomes typically outlined in a grant or initial agreement. Yet, on both the community organization and university researcher sides, values, time commitments, and leadership are likely to change. For Community Tech Workers, this occurred when Jefferson East, Inc.'s strategic vision shifted away from focusing on economic development and towards neighborhood safety. In response, the project team had to show Jefferson East, Inc. leadership that business development would increase revenue to the neighborhood as well as foot traffic—two interventions that have been shown to reduce crime [5, 8]. On University of Michigan's side for the Community Tech Workers project, one of the project leads left for another job (but he maintained his commitments to meeting with the providers regularly as an unofficial mentor). For Tech Help Desk, Community Forge's full-time staff nearly tripled over the course of the project, increasing the overall capacity of Community Forge to take on new projects and ownership of Tech Help Desk. As part of this expansion, there were several new programs created for entrepreneurs, such as the annual incubator, technology curriculum, and more recently a business service center. All the while, it was important to make time for conversations between the Tech Help Desk team and the leaders of these parallel efforts (e.g., linking Tech Help Desk as the technical office hours for entrepreneurs in the incubator, having a provider facilitate the design of tech curriculum materials, and so on). Taken together, both programs navigated the twists and turns of community-based engagements while staying true to the original vision.

Finally, beyond typical grant timelines, we found that healthy academic-community teams saw each other as "long-term friends" who may call on each other for mutual support, similarly to how long-term collaborating academic partners may call on each other for support. For instance, as the Community Tech Workers research project winds down, the university team continues to write grants to fund Community Tech Workers. In turn, Jefferson East, Inc. will be a potential partner for future University of Michigan research collaborations. In addition, Jefferson East, Inc. is considering having the Community Tech Workers project absorbed by a city-based entity that supports entrepreneurs. While this means the original model local to the neighborhood might change, the overall vision for supporting local entrepreneurs would be sustained on a broader scale. Ultimately, following suggestions for responsible engagement with communities [55], we believe goals should be community-driven to preserve outcomes that benefit community constituents.

7 LIMITATIONS AND FUTURE WORK

While this paper compares two community-based research projects aimed at tech capacity building for local business owners, the findings may be unique to the location and population context. Additional case studies with similar programs would confirm whether these themes are more widespread. However, by performing a comparison across studies, we take one step towards exploring the transferability of these findings. Furthermore, while this paper examined questions of sustainability, both programs have only been started in the last several years. Challenges and questions about sustainability may change with much longer projects. An important consideration is that this study primarily emphasized the perspectives of community leaders, and while valuable, it is also essential to incorporate the voices of the entrepreneurs who were served or impacted

and need to be considered for long-term sustainability. We are currently engaging with those who directly access these services across both programs, but have scoped these findings for future work. We also plan to discuss the findings shared in this article as a way to member check and move forward with new sustainability-related questions. We hope to continue exploring this topic as these programs age and welcome other researchers with longer community engagements to contribute their experiences.

8 CONCLUSION

While significant work has been done to understand how to initiate community-based research, our work extended this conversation to consider managing these projects' long-term visions and follow-through. Through comparative analysis across two case studies of tech capacity-building projects for local entrepreneurs, we identified three opportunities to consider sustainability: relational, financial, and technological. In our study context, relational sustainability referred to strategies for maintaining ongoing trusted relationships between the university team and community organization and between tech providers and local entrepreneurs. Our long-term partnerships prioritized transferring trust across academic and community personnel and continually set expectations that responded to evolving community initiatives. Financial sustainability considered both traditional forms of sustaining projects through grant funding and alternative models such as bartering and refundable deposits. Partnerships used academic support as a way to kickstart community initiatives, and reframed interventions to stay aligned with evolving community goals. Technological sustainability questioned the push for technology adoption and instead suggested reflecting on when and what technology was appropriate for each business situation. In addition, partnerships trained personnel to provide technical support alongside interventions and prioritized practical advice that resisted short-term trends. Taken together, our comparative case study highlighted concrete examples for these three areas and suggested ongoing questions and challenges to consider in future work, such as rethinking when longevity should—and should not—be the goal of community-based research in computing.

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A APPENDIX

Table 3. Side-by-side comparison of the two tech-capacity building models for local entrepreneurs in our comparative case study. Note: Some of our direct annual costs were paid out-of-pocket by PIs to abide by the financial restrictions of federal funds.

	Tech Help Desk	**Community Tech Workers**
Providers	Primarily volunteers from Carnegie Mellon University (students, faculty), one local volunteer	Primarily trained and paid local providers (university students and resident trainees)
Clients	Local entrepreneurs	Local entrepreneurs
Distance to Community Center	5 miles from Carnegie Mellon University	60 miles from University of Michigan
Model of Tech Support	One-to-one or one-to-few provider to entrepreneur(s) ratio	One-to-one and workshops for entrepreneurs (20-50 entrepreneurs)
Cost to Entrepreneurs	Free	Free
Frequency	Open hours twice a week: 1-5p Wednesday, 4-6p Friday, available by appointment outside open hours	Monday-Friday 9am-5pm appointment and walk-ins
Longevity	Sept 2019-Present	June 2022-Present
Topics covered	Broad computing support from organizing files and clearing device storage to building websites and using generative AI	Various business-related technologies (e.g., websites, social media, point-of-sale systems, web ads, search engine optimization)
Format	In-person at Community Forge, side-by-side, pair programming format (on Zoom when in-person meetings are not feasible)	In-person at Jefferson East, Inc. , business offices, or on Zoom
Funding sources	Federal funding, personal funds	Foundations
Direct annual cost	$2.4K (membership fees) + 400 provider volunteer hours. (Including $1K/month for office rental for a few months in 2020)	$68K per provider ($350K total for multiple providers and a manager)
Community Partner Points of Contact	Community Forge's Executive Director, Director of Business Services, Board Member	Jefferson East, Inc.'s Director of Business Services

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