PUBLIC INTEREST TECHNOLOGY UNIVERSITY NETWORK

UNDERSTANDING THE STATE OF THE FIELD IN 2021

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INTRODUCTION

The Public Interest Technology University Network (PIT-UN), created by New America in 2019, is working towards a future in which there is a growing demand for public interest technology professionals who can critically assess the ethical, political, and societal implications of new technologies, and design technologies in service of the public good. Underlying the Network's efforts is the central premise that universities and colleges are one of the main mechanisms to cultivate this group of professionals. In order to support the growth of a "public interest technology" field within academia, PIT-UN has sought to identify and support a set of universities and colleges that are committed to building out the field by developing curricula, research agendas, and experiential learning programs. If successful, the Network will have a critical mass of universities and departments committed to public interest technology, a diverse group of students interested in technology and its social implications, demand for their talents across sectors, and adequate funding to sustain the field.

The Network has now grown to 43 member colleges and universities including 30 R1 and four R2 institutions. Nine of the 43 members are Minority Serving Institutions (MSI), including one Historically Black College or University (HBCU), five Hispanic Serving Institutions (HSI), two Asian American and Pacific Islander Serving Institutions (AAPISI), and one HSI/AAPISI. Members apply for consideration to join the Network, with the required support and direct involvement of institutional leadership.

In order to affect institutional change, to date PIT-UN has asked member institutions to prioritize five field-building areas, with flexibility to focus on those most appropriate to their context. Priority areas include:

- Supporting interdisciplinary curricula and faculty development
- Creating experiential learning opportunities, including technology design and development
- Providing financial support and incentives to students
- Rewarding and recognizing faculty engagement
- Sharing institutional data for program evaluation and design

This report provides insight into the ways in which PIT-UN members are investing in the five priority areas, and sheds light on the state of the field more generally. It examines the maturity of PIT efforts across members, their priorities related to students, faculty and practitioners — including institutional infrastructure — as well barriers to growth. The data also begin to shed light on the pathways available to institutions in the earlier stages of PIT growth as they seek to foster community, align around a shared vision, and make preliminary investments. Finally, it wades into the ongoing debate about what encompasses "public interest technology" and provides some potential for clarity, based on the input of members.

EXECUTIVE SUMMARY

By any measure, the fields that comprise public interest technology (PIT) are flourishing across the institutions that make up the Public Interest Technology University Network (PIT-UN.) The diversity and creativity of programs and activities is inspiring, and suggests that universities are innovating to meet market demands and prepare their students for 21st century careers that necessitate socio-technical competence. Indeed, what began as a simple landscape scan grew in complexity given the wealth of activity underway, with our efforts uncovering more than 1,300 related programs, initiatives, and resources across the 43 member institutions.

Nevertheless, there is ample room for growth even amongst existing members. Half of PIT-UN members believe their public interest technology efforts are mature, while the other half report still being in the early stages. Very few members referenced having created a comprehensive strategic plan pertaining to or inclusive of public interest technology. This suggests many may be letting the field grow organically or selectively seeding projects, particularly via the PIT-UN Challenge Grant, rather than aligning around priorities where they plan to affect change at scale. The creation of new courses was the primary mechanism through which members are raising awareness of the field. Half have also created a steering committee or working group to coalesce interests and break down silos. These provide a strong foundation on which to chart a course forward.

However, lack of funding for PIT initiatives has been identified as the primary impediment to growth. In addition to funding being a primary barrier, current members appear overly reliant on PIT-UN funding to support related efforts. It was the most frequently cited funding source — selected by nearly three-quarters of members. Just under half selected federal grants as a source of related support, though almost 80 percent of PIT-UN members are R1 or R2 institutions. This suggests an opportunity for better connection to federal funding agencies, like the National Science Foundation.

Data science, machine learning/AI, and cybersecurity are emerging as primary technical foci, while race and social justice, and ethics were identified as the primary public interest foci of current members. Indeed, 75 percent of members believe that a core premise of PIT is "nurturing the ethical fluency of technologists." However, race, justice, or ethics were rarely in evidence in the naming of related academic programs, including degrees as well as minors, concentrations, and certificates, suggesting a significant opportunity to better signal student expertise to employers. Leadership also has an opportunity to emphasize ethics and racial justice broadly as core priorities in curricular resources, seed funding, professional development, and research related to public interest technology.

It is unclear whether public interest technology efforts are effectively engaging a diverse community of faculty and students, which remains an urgent task given the enduring lack of diversity in technical fields. Diversifying the talent pipeline has been a key priority for PIT-UN and a core focus of the Network Challenge grant program. Yet, survey respondents gave their institutions relatively poor marks for attracting underrepresented minorities, women, and nonbinary students to STEM fields. To broaden participation in public interest technology, specifically, members are chiefly focused on targeted recruiting of underrepresented faculty and students, and experiential learning. Just a third report directing significant financial aid to underrepresented groups pursuing related degrees. The landscape scan yielded select examples of pipeline programs, including K-12 schools summer institutes and degree pathways, partnerships with community colleges, or tailored mentoring or training programs targeted expressly to underrepresented groups. A handful are also working to change culture, including mitigating the risk of bias via training and diversifying curriculum. Nevertheless, this is an area where considerable additional investment of time and resources appears warranted, including greater scrutiny of demographic data, so institutions can set clear targets and hold themselves accountable. Members would likely also benefit from building and sharing evidence of what works.

When it comes to education, members believe their institutions are adept at enabling curricular innovation, but are less sanguine about efforts to expressly enable interdisciplinary teaching. The merger of social and technical competencies is core to the maturation of public interest technology, and a key emphasis of PIT-UN. As mentioned, the formation of new PIT-oriented courses is the mechanism through which the majority of members are raising awareness of the field, suggesting curricular innovation is well underway. But just 17 percent of survey respondents

strongly agree their institution does a good job enabling interdisciplinary teaching. The landscape scan yielded some examples of seed funding and other supports to enable interdisciplinary teaching. But other models of "curricular diffusion," such as Embedded EthiCS programs, may be important to scale as they allow relevant expertise to be integrated into courses without necessarily necessitating co-teaching.

Students are playing an instrumental role at many universities in promoting and advancing the field, including in some instances leading experiential learning programs. The extraordinary array of student clubs struck the authors as a huge opportunity for the network and institutions. Students are also leading key dissemination channels that help raise awareness of PIT, from law journals to podcasts. The many PIT working groups and alliances, and PIT-UN itself, have an opportunity to integrate student leaders into decision-making. Indeed, if community-engaged design and co-creation is a core tenet of PIT, members would do well to engage students as stakeholders. There is also an opportunity to create more PIT-centric initiatives that facilitate inter-university student engagement, regionally or nationally.

Across the five areas prioritized by the Network to date, experiential learning is the area where we observed a particularly inspiring breadth of programs. In all, our landscape scan revealed more than 120 relevant experiential learning programs across nearly every member of PIT-UN. Clinics have a strong tradition in law schools, which continue to be a hub of significant related programs, while others may focus expressly in disciplines like data science, AI, or geographically, such as on local urban or community challenges. Some schools, like Olin and Stanford, have robust PIT experiential learning programs led by students. Internship programs were also popular, though members believe their institutions do a better job encouraging private than public sector careers.

While successes abound, the term "public interest technology" has not yet taken hold within the academy. Programs and institutes that make use of the term are exceedingly rare. There also continues to be a sense that the field itself encompasses nearly every related sub-field. Nevertheless, members overwhelmingly agree that public interest technology is focused on: nurturing ethical fluency of technologists, using data and technology to make people's lives better, and community and user-engaged design processes. These three markers alone may help current and future members to assess their own strengths, identify gaps, and assemble the right allies to move the field forward. Certainly, they suggest an opportunity for future workshops and research.

PROJECT BACKGROUND

This project was designed to evaluate the state of the field across the 43 academic institutions that make up the Public Interest Technology University Network as of the summer of 2021. The original goals were three-fold:

1. Provide a rigorous and comprehensive baseline of student-oriented, faculty-oriented, and institutional activities, including related courses and degrees, and practices being undertaken to advance the field of public interest technology.

2. Evaluate the degree to which "public interest technology" is entering the academic lexicon.

3. Understand the trajectory of member institutions from 'nascent' to 'mature', and associated activities and practices, in order to provide a roadmap for new members.

A member survey, developed by Boston University in collaboration with PIT-UN leadership, was e-mailed to all member designees and co-designees in June 2021. Respondents were asked to complete the survey by July 31. Forty-two of 43 member institutions responded.

The member survey was complemented with a scan of publicly available information, which was primarily gathered between June and September 2021. This approach allowed the team to systematically "ground truth" member perceptions, explore trends and gaps in PIT activities across the member network, and surface noteworthy activities or programs. As this was the first such undertaking of this scale, we cast a wide net. Below is a summary of the categories of activities and programs explored, across each of the four broad domains of interest. [Definitions and criteria are available in the Appendix.] We also explored a cross-cutting category of "pipeline" programs, which seek to increase engagement of underrepresented groups in public interest technology, including current and prospective students and faculty.

Table 1. Categories of PIT-Related Activities and Programs

| Institutional	Faculty-Centric	Student-Centric	Practitioner-Centric
Research Seed Grants	Academic Fellows	Academic Fellows	Practitioner Fellows
Research Centers/ Institutes	Teaching/Curricular Supports	Student Clubs	Professional Certificates
Research Initiatives	Continuing Education/ Professional Development	Co-Curriculars	Continuing Education/ Professional Development
Research Consortiums		Experiential Learning Programs	
Interdisciplinary Unit/ Program		Internships/Practicums	
Dissemination		Undergraduate Concentrations	
Tools/Resources		Undergraduate Certificates	
		Undergraduate Degrees	
		Master's Degrees	
		Doctoral Degrees	
		Graduate Concentrations	
		Graduate Certificates	

INSTITUTIONS

BUILDING MOMENTUM FOR PUBLIC INTEREST TECHNOLOGY

Member institutions are split evenly into those who consider their public interest technology initiatives to be relatively early stage and those who perceive their efforts as later stage or mature. Half of respondents characterized their institution's initiatives as either "nascent" or "growing but narrow," while the other half characterize their efforts as "growing and broad" or "fully realized."

Figure 1. Maturity of PIT Initiatives, Self-Reported by PIT-UN Members

Would you characterize your institution's initiatives in public interest technology as:

- Mature/Fully realized — 5%
- Growing and broad — 44%
- Growing but narrow — 42%
- Nascent — 9%
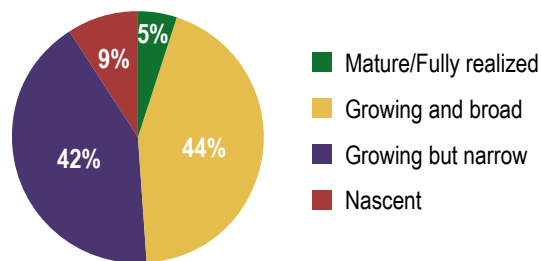
While our sample is too small to draw any firm conclusions, we examined whether there were any notable distinctions between these two cohorts. Early-stage institutions included nearly all of the colleges and M1 institutions, except for Olin College of Engineering and Pardee RAND Graduate School which perceive their efforts as later stage. At both Olin and Pardee RAND, public interest technology is central to the school's mission and a core thrust of their educational programs. Interestingly, R1 and R2 institutions were evenly divided, with 16 of these schools perceiving their efforts as early stage and 17 as later stage, suggesting room for considerable growth.

Member institutions are undertaking a wide variety of initiatives to raise the profile of public interest technology across their community [Figure 2.] New PIT courses and internal media coverage top the list. Half of respondents also note the formation of a multi-disciplinary steering committee. One example, notable for its scale and scope, is the NYU Alliance for Public Interest Technology, which has a 15-member Steering Committee and 69 faculty affiliates spanning multiple schools, and is led by staff from the Center for Faculty Advancement.

Half of respondents noted they were undertaking other activities, beyond those listed. Examples include: creating new PIT research centers; PIT student clubs; a website of existing activities; adapting existing programs or degrees; and seeding related research. San Jose State University noted they have new "scholarship of engagement" tenure criteria alongside more traditional promotion criteria, and are using philanthropic funds to seed public impact technology research.

Respondents were also asked to home in on the "single best thing" they have done to foster a shared vision for public interest technology across their institution. Two themes emerged from their open-ended responses. The first is the need to devise relationship infrastructure like multi-disciplinary steering committees. Elizabeth Newton of The Ohio State University referred to this as *"build[ing] institutional muscle that is practiced in partnering."* Fourteen respondents cited new formal relationship infrastructure, such as interdisciplinary faculty steering or advisory committees, working groups, or a "community of practice" as the best thing they had undertaken to foster a shared vision.

> *"Our theory of change is that small amounts of support can help convene an influential community of practice by overcoming hurdles and nudging institutional behavior."* — KAREN LEVY & MALTE ZIEWITZ, CORNELL UNIVERSITY

Figure 2. Raising the Profile of Public Interest Technology

How are you raising the profile of public interest technology at your institution? [Select all that apply]

Category	Percentage
Creating new PIT-oriented courses	85%
Sought media coverage within my institution	77%
Created multi-disciplinary steering committee to oversee efforts	50%
Sought external media coverage	48%
Other	48%
Hosting PIT-oriented career panels/fairs	38%
Creating new PIT-oriented certificates or minors	35%
Hosting a PIT conference	33%
Creating new PIT-oriented degrees	33%
Publishing report on existing PIT activities at my institution	21%
Nothing yet	8%

The second theme that emerged is in relation to student-oriented initiatives, which were cited by an equal number of respondents. These institutions referenced the formation of new experiential learning clinics, degree programs or courses, or supporting the formation of new student clubs. Finally, six respondents referenced the formation of new centers or institutes. Just three — Arizona State University, Stanford University and Case Western University — referenced comprehensive strategic plans pertaining to or inclusive of public interest technology.[1]

Taken together, these responses suggest two common pathways for network members to foster a shared vision for PIT: a faculty-first or student-first approach. We note that both pathways are priorities for PIT-UN, so this finding reveals the degree to which members are capitalizing on the flexibility provided.

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1   Additional members may have plans underway, but failed to reference them as instrumental to vision setting, while others may have begun in earnest since the survey was conducted.

Even those who cited student activities as being paramount noted that interdisciplinary degree programs, courses, or certificates are themselves a mechanism by which to foster new faculty relationships across disciplinary silos,suggesting a student-first approach nevertheless nurtures faculty interest. It is also worth noting that strategic plans and additional new institutes may emerge as a result of some of the faculty alliances and working groups indicated, though the lack of emphasis on comprehensive plans suggests most schools are building the plane while flying it. Network members, including new entrants, may benefit from insight into strategic planning processes at other institutions — including pitfalls and successes — as they chart a course for the future.

One respondent referenced a preference for a decentralized model, sharing: *"We see the principles underlying PIT to be broadly shared across our institution, as reflected in research and education taking place across many of our schools and departments. So we see the need to have a single defined "home" for PIT at the University to be unnecessary, and perhaps, as some faculty have suggested, even a bit counterproductive."*

Members were also asked to comment on how their institutions support interdisciplinarity in general. Here interdisciplinary research centers were the most commonly referenced institutional infrastructure, cited by 90 percent of respondents. [See FACULTY section for a deeper discussion of research centers.] Seed funds were the next most common (75 percent), followed by dual faculty appointments (69 percent) [Figure 3.] Interdisciplinary teaching was cited by 58 percent of respondents, slightly fewer than those who cited multi-disciplinary academic units or embedding dual disciplines on doctoral committees. But it is noteworthy that research infrastructure was significantly more likely to be cited. These findings suggest future mechanisms by which the field of public interest technology could continue to expand and mature, particularly via the development and growth of dedicated research centers.

Figure 3. Institutional Support for Interdisciplinarity

How does your institution support interdisciplinarity in general? [Select all that apply]
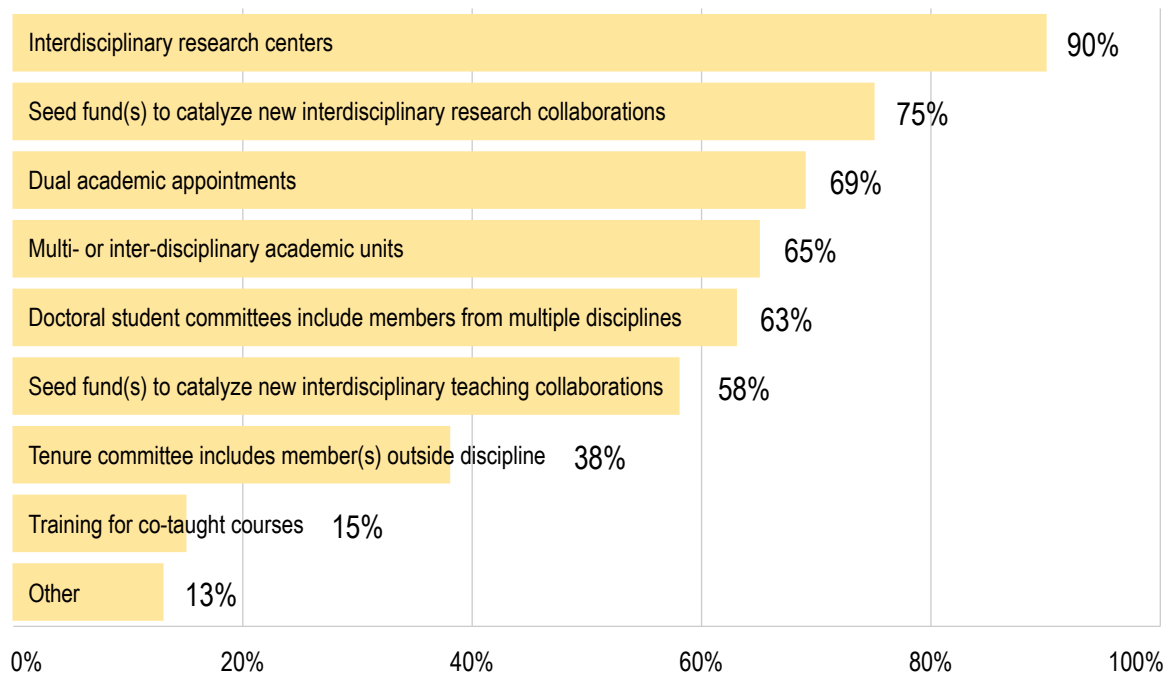
The scan of member activities also yielded insight into the range of engagement and dissemination activities universities are employing to reach a wide audience, bring more perspectives to the table, and celebrate their own research. Public events, podcasts, and academic journals were popular, and we also unearthed relevant writing series and blogs. This category of activity is notable both for the number of dissemination channels we came across and the opportunity to potentially nurture a community of public interest technology publishers and storytellers.

The [Future Out Loud](#) podcast at Arizona State University (ASU) explores the intersections of technology, society, and risk. California Polytechnic State (Cal Poly) University's podcast [Technically Human](#) addresses ethics and technology and what it means to be human in the age of technology, while Georgetown University's student-run [Between Two Codes](#) highlights timely work by their Institute for Technology, Law, and Policy affiliates. The Constellations Center for Equity in Computing at Georgia Tech hosts [VOICES](#) (Voices of Innovative Compassionate Experts in Society) as a podcast and video interviews shared on YouTube to engage experts on social justice issues facing American society.

Written publications took many forms, ranging from journals to blogs to writing competitions. The Harvard Kennedy School's [Misinformation Review](#) is an open access 'rapid' peer-reviewed journal. The Center for Information Technology Policy at Princeton hosts [Freedom to Tinker](#), a blog on digital technologies in public life that is open to graduate student authors. [The Ohio State Technology Law Journal](#) is an interdisciplinary journal run by students at OSU's Moritz College of Law and focuses on research and commentary at the intersection of law, policy, and information technology. The New America Foundation, Slate magazine, and ASU launched [Future Tense](#) to publish content on technology and innovation in society on Slate.

ENGAGING UNDERREPRESENTED GROUPS

The goal of investing in public interest technology as a field is both to transform technical education as well as the pipeline of technical talent. PIT-UN members are encouraged to diversify engagement and bring new stakeholders to the table. The evidence is clear that technical fields continue to be dominated by men, particularly white men, so efforts to engage underrepresented minorities, women, LGBTQ, and non-binary students and faculty are key to fostering a new talent pipeline.

A 2020 analysis of computing occupations across the US revealed that just 25 percent of roles are held by women, including seven percent by Asian women, three percent by African-American women, and two percent by Hispanic women.[2] An analysis of EEO-1[3] data submitted by 177 Silicon Valley Tech firms, as part of federal reporting requirements, determined that 7.3 percent of employees were Latinx and 4.4 percent were Black. Together they held just 4.4 percent of executive roles. The same study showed women held 30 percent of jobs at those firms, and just 21 percent of executive roles.[4] Many other reports come to similar conclusions.[5] A recent survey of major tech firms by McKinsey found that a negligible fraction of their charitable giving was focused on increasing the representation of women in the tech talent pipeline, suggesting ample room for growth.[6]

Survey respondents offered limited praise for their institutions' efforts to attract underrepresented students to STEM fields [Figure 4.] Just 10 percent strongly agree their schools do a good job attracting underrepresented minorities and 17 percent strongly agree they do a good job attracting women and non-binary students to STEM fields. This relatively weak endorsement of existing efforts also suggests ample room for improvement.

2   https://wpassets.ncwit.org/wp-content/uploads/2021/05/13192101/ncwit_btn_03252021_fullsize.pdf

3   The Equal Employment Opportunity Commission mandates that private employers with more than 100 employees and federal contractors with more than 50 employees submit employee demographic data on an annual basis broken down by race/ethnicity, gender and job categories. Referred to as EEO-1 reports, these are an invaluable source of information. Recent years of reporting were delayed due to the pandemic.

4   https://www.umass.edu/employmentequity/sites/default/files/CEE_Diversity%2Bin%2BSilicon%2BValley%2BTech.pdf

5   https://www.eeoc.gov/special-report/diversity-high-tech; https://www.whitehouse.gov/wp-content/uploads/2021/09/091621-Best-Practices-for-Diversity-Inclusion-in-STEM.pdf; https://www.aauw.org/app/uploads/2020/03/Solving-the-Equation-report-nsa.pdf

6   https://www.rebootrepresentation.org/wp-content/uploads/Rebooting-Representation-Report.pdf

Figure 4. Engaging Underrepresented Groups
Please rate how strongly you agree/disagree with the following statements about your college/university.

● Strongly agree   ● Agree   ● Neither agree nor disagree   ● Disagree   ● Strongly disagree

Does a good job attracting underrepresented minority students to STEM fields

10%   31%   51%   8%

Does a good job attracting women/nonbinary students to STEM fields

17%   40%   35%   8%
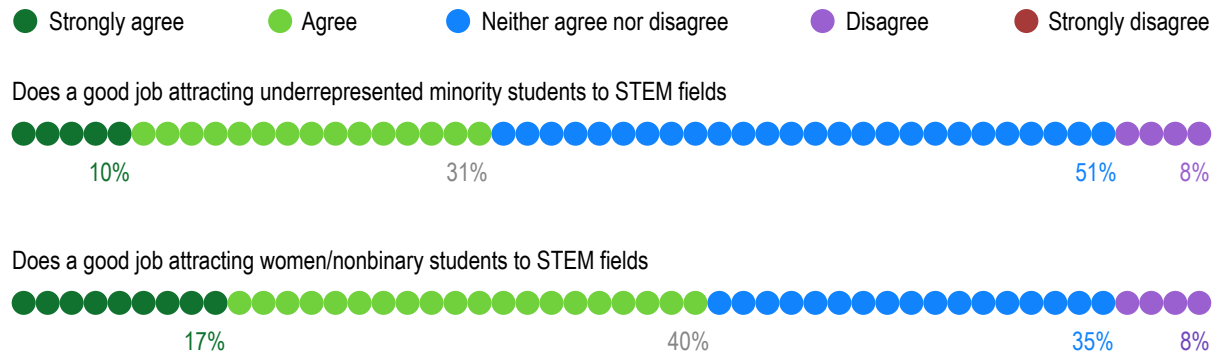
Institutions report employing a variety of strategies to engage underrepresented groups in their public interest technology initiatives and programs [Table 2.] The average institution is employing five of the strategies included on the survey, though this may be an undercount as respondents may not be aware of all of the related programs offered by their institutions. Indeed, in the instances where we had multiple respondents from the same institution, there was considerable variation in responses on this question. One respondent noted efforts such as those referenced exist at their schools, but are not expressly related to PIT.

Among the engagement efforts of which survey respondents are aware, targeted faculty and student recruiting top the list, along with creating opportunities for students to work on projects with real-world impact. Less common was providing significant financial aid to underrepresented groups (33 percent) or creating student pipeline partnerships with community colleges (35 percent.) Just one in five report offering living/learning communities for these populations, like the WISE (Women in Science & Engineering) housing at Boston University and University of Michigan.

We did not find any notable distinctions in the number of strategies employed between MSI and non-MSI schools. In contrast, respondents from research universities (R1, R2) reported slightly more strategies being employed to engage underrepresented groups, on average, relative to other types of schools.[7]

The concurrent landscape scan identified 29 related "pipeline" programs, not counting student clubs, designed to diversify the community of students and faculty engaged in public interest technology and related fields. Table 3 provides a summary of some of the programs that emerged via the scan.

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7   This finding is directional, as our survey sample included nine schools that are not classified as either R1 or R2 research universities.

Table 2. Strategies to Engage Underrepresented Groups

Which of the following strategies, if any, have you employed to engage underrepresented groups in your PIT initiatives and programs? [Select all that apply]

Response	Percentage
Recruiting underrepresented faculty members	67%
Real-world projects/opportunity for impact on issues relevant to underrepresented groups	65%
Targeted recruiting to attract underrepresented students	65%
Real-world projects/opportunity for impact generally [e.g., Hack4Impact; clinics]	63%
Support for relevant student clubs [e.g., National Society of Black Engineers; Girls Who Code]	52%
Courses taught by underrepresented faculty	44%
Recruiting underrepresented staff members	42%
Student transfer/pipeline partnerships with community colleges	35%
Significant financial aid to underrepresented groups pursuing related degrees	33%
Hackathons designed to attract underrepresented groups [e.g., HBCUHacks; SheHacks]	27%
Living/learning communities [e.g., Women in STEM dorms/houses]	19%

Table 3. Diversifying Public Interest Technology: Sample Pipeline Programs

Target Audience	Program	Description
K-12 Students	Advancing Strategies in Cybersecurity Education and Career Development (ASCEND)	Strengthens pipeline of underrepresented minorities in cybersecurity workforce by providing high school teacher training, summer camps, and dual enrollment for high school students, and additional mentorship and job placement supports for students in Associate's program in Cybersecurity [Miami Dade College: Link]
Undergraduate Students	Policy, Science, Technology & Society Scholars (POSTS) Program	Year and a half long training and career mentorship program to attract more women, minorities, and persons with disabilities to science and technology studies and science policy. Eligible sophomore and junior undergraduates drawn from seven universities. [ASU; GeorgiaTech; UVA; Michigan State; NC State; UC Santa Barbara; U Maryland: Link]
Faculty	Public Interest Technology Institute	Two week bootcamp and year-long mentorship program for early- and mid-career scholars from any institution, including faculty and post-docs, from groups underrepresented in technology who want to accelerate their work in public interest technology [NYU: Link]
Practitioners	DataWorks	Recruits people from economically disadvantaged neighborhoods and underrepresented groups in computing to train and employ them as Data Wranglers and Data Developers. Paid trainees use real-world data from Atlanta non-profit organizations. [GeorgiaTech: Link]

Universities also have an opportunity to integrate public interest technology themes into forums that engage groups underrepresented in technical fields. Rochester Institute of Technology (RIT) offers one such example. RIT's Future Stewards Program partners with Tribal Nations and students to create opportunities for Native scholars. Future Stewards is launching a new "PIT in Tribal Communities" initiative to support student fellows and faculty researchers in addressing community-identified needs. Arizona State also engages Native communities via its Indigenous Design Collaborative, a "community-driven design and construction program" that "prioritizes historical

understanding, community-driven metrics, Indigenous design thinking, technological innovation, local vernacular intelligence, holistic systems solutions thinking, and collaboration with local practitioners."

The University of California, Santa Cruz (UC Santa Cruz) Institute for Social Transformation hosts All-In: Co-Creating Knowledge for Justice Conference, which brings together scholars, students, community members and organizers, foundations, artists, and activists from across the country to share best practices and innovations in community/university partnerships. Though not expressly focused on technical challenges, it is focused on two of the core tenets of public interest technology: community-engaged research and social justice. A conference or working group, like All-In, could for example include panels focused on research/practice partnerships to address socio-technical challenges, or discussions of ethics and community-based technology.

This is one area where member institutions may benefit from both sharing best practices and developing more comprehensive inventories of existing programs and activities on which to build. Given the widely acknowledged lack of racial and gender diversity in technology fields today, PIT-UN would do well to focus additional resources in this area, particularly in relation to helping members set specific targets, and funding and sharing evidence of effective programs that increase the participation of underrepresented groups in PIT to achieve those targets. It is a topic that warrants a standalone report, particularly as just 20 percent of current PIT-UN members are Minority-Serving Institutions.

PUBLIC INTEREST TECHNOLOGY DISCIPLINARY FOCI

The survey and landscape scan yielded insight into the disciplinary and thematic priorities of members. Members were asked to separately identify the current technical foci and public interest foci of PIT courses and programs at their institutions. Their responses helped to guide subsequent coding of activities and programs identified via the landscape scan. They also serve as a reminder that the success of public interest technology may be predicated on the ability of institutions to integrate these foci in substantive ways. Supporting interdisciplinarity and curricular diffusion, which we discuss later, are key [See FACULTY.]

Figure 5. Technical Foci of PIT Programs/Courses
What are the primary TECHNICAL foci of PIT courses and programs at your institution today? [Select all that apply]

Category	Percentage
Data Science	88%
AI/Machine Learning	75%
Cyber Security/Data Security/Cryptography	58%
Geographic Information Systems	48%
User Experience Design	48%
Engineering	42%
Internet of Things/Smart Solutions	38%
Privacy	35%
Virtual Reality/Augmented Reality	25%
Other	21%
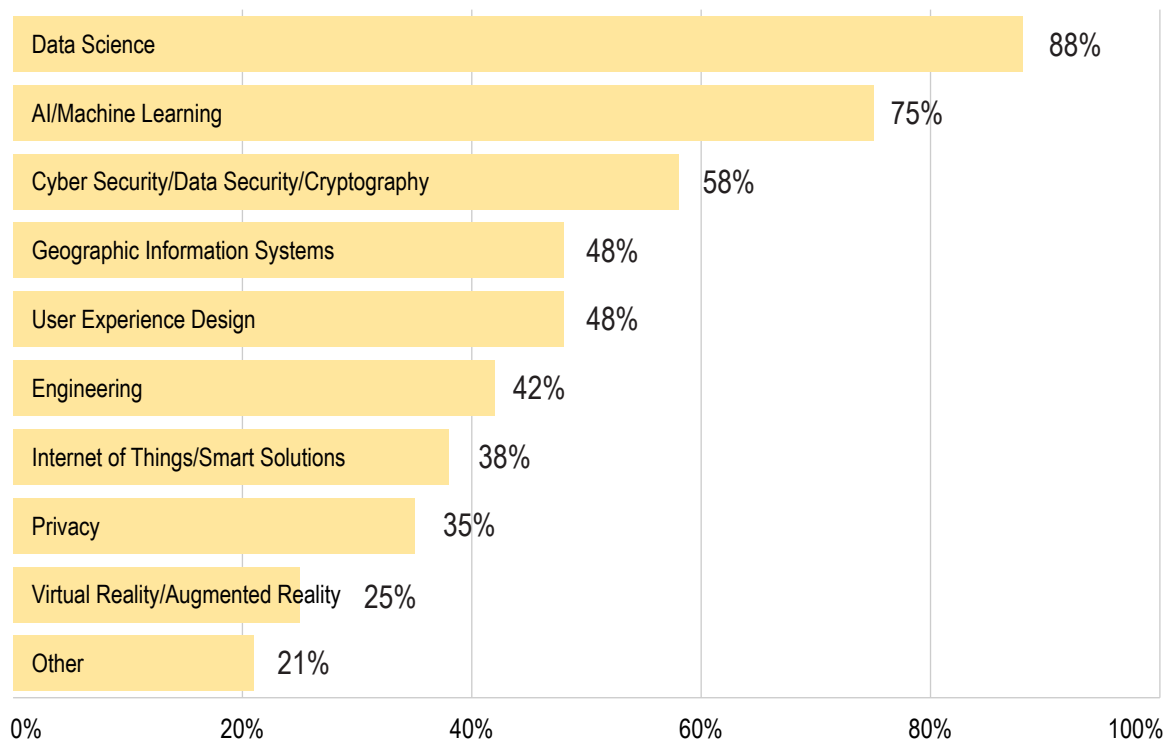
Data science is a priority area for the vast majority (88 percent) of PIT-UN members, followed by Machine Learning/AI (75 percent) and Cybersecurity (58 percent.) These findings prompted our team to scrutinize data science, artificial intelligence/machine learning, and cybersecurity offerings across member institutions.[8]

Data science related initiatives at member institutions are, not surprisingly, very common. Our search yielded 125 distinct student degree programs, minors, experiential learning programs, and clubs explicitly focused on data science or analytics, and another 33 research centers or initiatives. A handful of schools offered professional certificates pertaining to data science. A few schools also host inter- or transdisciplinary workshops that engage a wider array of stakeholders, including Georgia Tech's annual Data Science for Social Good Workshops, University of Virginia's Data Science for the Public Good Forum and the recent Citizen Data Science Summit at MIT.

Figure 6. Public Interest Foci of PIT Programs/Courses
What are the primary PUBLIC INTEREST foci of PIT courses and programs at your institution today? [Select all that apply]

Focus	Percent
Racial/Social Justice	71%
Ethics	67%
Environment/Sustainabilty	56%
Cities/Urban Issues	52%
Government	50%
Education	46%
Public Health	44%
Infrastructure	44%
Law	40%
Criminal Justice	33%
Transportation	31%
Media/Journalism	31%
Healthcare	27%
Economy	27%
Food Systems	25%
Other	25%
Housing	17%
Public Safety	15%
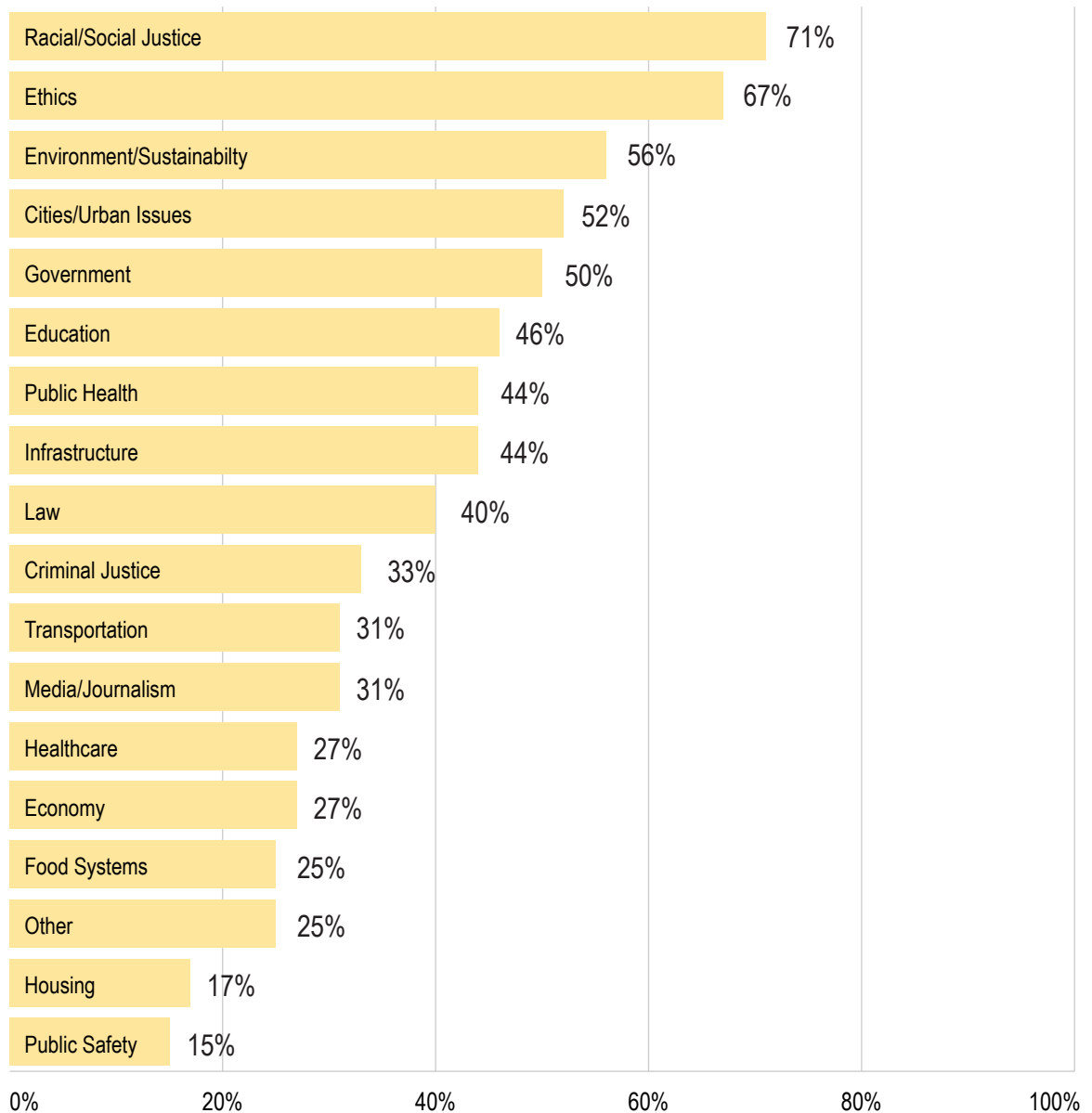
8   A program, degree, club, or center needed to explicitly reference relevant terms in the name to be included in our count. We recognize this may lead to undercounting, but also note that naming conventions play an important signaling and credentialization functions, both for students and faculty who elect to engage or enroll in a particular program.

We identified 50 student-oriented degrees, certificates, programs, and clubs across 24 members pertaining to cybersecurity, and another 26 related research centers or initiatives across 20 institutions. As noted earlier, Miami Dade College offers multiple programs for high school students to build a pipeline of talent focused on cybersecurity, and a handful of schools offer professional education programs that provide practitioner credentialization in cybersecurity.

An emphasis on artificial intelligence and machine learning was less apparent in the naming of programs, as we found 46 programs, centers, degrees, and clubs in total that explicitly referenced either field. William & Mary noted two creative mechanisms to engage a wider audience in discussions of AI, including an AI Writing Competition and Exhibit AI, a podcast series hosted by its Center for Legal and Court Technologies.

Race/social justice (71 percent) and ethics (67 percent) top the list of public interest foci of PIT-UN members. However, relative to technical areas of expertise, schools rarely signal their emphasis on these two areas in the naming of related programs and initiatives. A reference to ethics was included in roughly 30 of the PIT-related activities we unearthed across 17 member institutions, though we note a significant number are concentrated at Stanford University via the activities of the McCoy Family Center for Ethics in Society and the Ethics, Society, and Technology Hub. In total, we identified eight student-centered programs like student clubs or minors/concentrations, and 14 research centers or research initiatives that center ethics alongside technical disciplines. We identified only 11 programs or initiatives — again, with clear links to technology, data, or science — which make reference to justice, and just three that reference race or racism in their nomenclature.

Without a doubt, more programs or centers than those noted may emphasize ethics and race and social justice in their descriptions, if not in the title or naming convention. We also note that we inevitably missed at least some existing or emergent programs and centers. Nevertheless, we want to draw attention to the stark contrast in emphasis relative to technical fields, which is particularly notable given the number of respondents who perceive these areas to be *primary* public interest foci for their PIT efforts.

In addition, we were unable to find any degree programs, certificates, or minors that explicitly reference the intersection of race/racism, ethics/bias, and technology. Many degrees, concentrations, certificates, and minors emphasize "society" alongside technology or data science, and interestingly three schools have created a minor that references women or gender [Table 4.] The *Gender, Race, Culture, Science & Technology* minor at Cal Poly is the only socio-technical minor, concentration, or degree we identified at any PIT member institution that references race.

Table 4. Examples of Undergraduate Credentials Referencing Race, Justice, Gender, or Ethics

Race/Gender/Justice	Cal Poly – Gender, Race, Culture, Science & Technology minor track Virginia Tech – Gender, Science & Technology minor Georgia Tech – Women, Science & Technology minor
Ethics	Nazareth – Ethical Data Science, BS Cornell – Information Ethics, Law & Policy Concentration Cal Poly – Ethics, Public Policy, Science & Technology minor track Stanford – Ethics & Technology minor

The lack of explicit emphasis on ethics is even more surprising, considering that 75 percent of survey respondents strongly agree that a core premise of public interest technology is "nurturing ethical fluency of technologists." We identified just four academic offerings that elevated ethics as a primary focus in the naming convention, and all were undergraduate level.

Collectively, these findings suggest an opportunity for all PIT-UN members to elevate and increase the visibility of race and ethics in naming conventions and student program foci, both in order to attract interested students and to signal increasingly important subject matter expertise to employers.

Universities have an opportunity to emphasize ethics and racial justice broadly as core priorities in curricular resources, seed funding, professional development, and research, as well as in degree and credential programs. Some are creating programs and initiatives to foster a culture that prioritizes inclusion and mitigates bias and stereotype threat in all aspects of learning and research. In other words, they are transforming culture, along with content.

On the curricular side, The Pennsylvania State (Penn State) University's [Equity Pedagogy Network](#) — which was itself funded by one of the university's own strategic plan seed grants — hosts multiple learning communities and a speaker series devoted to the discovery and adoption of "anti-racist, equity pedagogy models and materials." Supported groups include a [STEM-focused Faculty Learning Community](#) that met throughout the Spring of 2021. Princeton University's Council on Science & Technology has also created a [Community of Practice Fellowship](#) focused on diversifying science and engineering curriculum. The fellowship will bring together faculty to explore and implement a more diverse curriculum and provide them with $10,000 stipends.

Additional professional development supports include Princeton's Keller Center for Innovation in Engineering Education, which offers a noteworthy [Program in Institutional and Historical Racism in Engineering, Technology and Innovation](#). Designed for faculty, post-docs, researchers, and staff in the School of Engineering, it is a six-month learning program designed to provide a foundational understanding of structural racism. The University of Texas at Austin (UT Austin) used PIT-UN funding to create a new [Social Justice Informatics Faculty Fellows Program](#). Twenty-four faculty fellows will be selected from Huston-Tillotson University and UT Austin for a yearlong fellowship to "provide training in social justice informatics, produce collaborative cross-institutional research teams, and provide a proof-of-concept for city-wide collaboration across universities, government, and nonprofits."

With regard to ethics, the Stanford Institute for Human-Centered Artificial Intelligence recently created an [Ethics and Society Review Board](#) for AI research, which requires those seeking Institute funding to evaluate and mitigate ethical and societal risks posed by their research.

Environment/sustainability, cities/urban issues, and government were the only other public interest areas cited by at least half of respondents. The priority placed on all three suggests opportunities for greater third-party funding, particularly given the recent emphasis of the National Science Foundation (NSF) on transdisciplinary socio-technical research in areas like [sustainability, smart and connected communities, and civic innovation](#). NSF is also increasingly encouraging applicants to meaningfully invest in more diverse partners. As one example, the recent NSF call for [Sustainable Regional Systems Research Networks](#) required applicants to include a core partner that serves groups underrepresented in STEM (including MSIs) and required they receive a significant portion of the grant funds. PIT-UN could partner with NSF or its own members to mentor peers who may have had less success or interest in pursuing federal funding for PIT research and education. As discussed in greater detail below, it will be important for members to diversify funding sources.

BARRIERS TO GROWTH

To date, sources of public interest technology funding seem strikingly limited. Nearly three-quarters of respondents cited PIT-UN as a funding mechanism for their PIT initiatives [Figure 7]. While the proportion citing PIT-UN funding is — in itself — not worrying, the fact that it was the most frequently cited source of funding in a cohort where R1 and R2 institutions dominate is cause for concern. Major research universities are motivated by and reliant on federal funding, yet just half of the R1 and R2 survey respondents said their PIT efforts receive federal funding. PIT-UN may want to consider additional engagement with or emphasis on complementary federal or foundation funding programs to ensure continued support of PIT initiatives by senior university leadership. Sustained leadership support requires financial upside, alongside alignment with the strategic vision and mission of an institution.

Continued financial support from PIT-UN will also be important, and multiple respondents noted the importance of the Challenge Grants to raise awareness of public interest technology, and the network more generally, among their faculty.

Figure 7. Funding for PIT

How are your public interest technology initiatives funded? [Select all that apply]
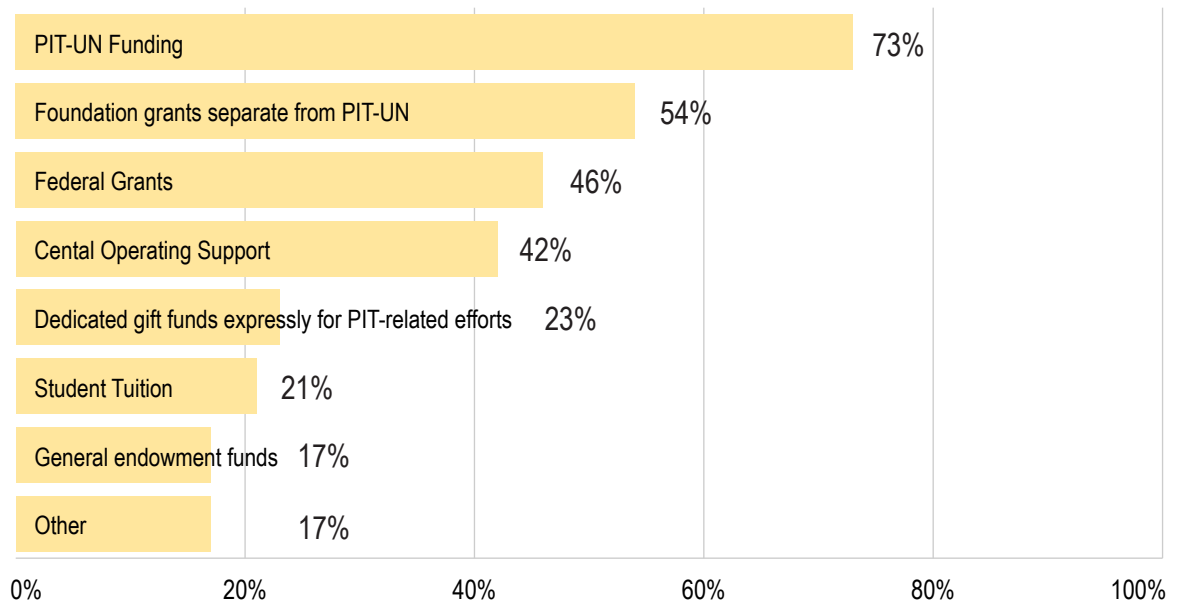
The need for added emphasis on diversity of funding sources is due, in part, to the fact that respondents also noted lack of funding was the primary barrier they face in expanding their public interest technology efforts. Limited staff and the newness of the field were also cited by slightly more than half of respondents as being key barriers to growth.

Forty percent of respondents mentioned either disciplinary silos or lack of faculty who possess both technical and public interest expertise as challenges. Even when they can find suitable colleagues, it may be difficult to find the right academic unit. As one respondent noted: *"Recruiting public interest tech faculty and staff is a challenge for various reasons, including finding appropriate home departments or finding appropriate positions for non-traditional academics/staff members within the University ecosystem."*

We also examined distinctions between barriers reported by minority-serving institutions (MSIs) relative to other schools. MSIs were more likely to report lack of faculty buy-in as a barrier to growth, with half citing this concern. Three quarters of respondents at MSIs pointed to the lack of faculty with dual expertise as another key hurdle, relative to just a third of non-MSIs. The number of MSIs among PIT-UN membership is relatively small, so we note these findings are only directional. But, as the network grows to encompass more institutions devoted to serving diverse populations, it will be important to understand and address their distinct needs and challenges.

Figure 8. Hurdles for Growing PIT
What are the biggest hurdles you face, if any, in growing your PIT efforts? [Select top 2]

Hurdle	Percentage
Lack of funding	69%
Limited staff resources	54%
Newness/Lack of familiarity of the field	52%
Disciplinary Silos	40%
Lack of faculty who possess both technical and public interest expertise	40%
Inflexible courses/Degree requirements	31%
Lack of faculty buy-in	15%
Challenges sourcing/Scoping real world projects	15%
Other	15%
Lack of institutional leadership buy-in	8%
Nothing/No hurdles	4%

FACULTY INFRASTRUCTURE

PIT-UN has prioritized faculty support and recognition as a key field-building area. Earlier we noted the importance members are placing on building a diverse pool of faculty and the potential challenges of attracting those with socio-technical expertise. Here we delve deeper into the types of infrastructure members are creating to support faculty as educators and researchers.

SUPPORTING FACULTY AND ENABLING INTERDISCIPLINARITY

Overall, respondents were complimentary of their institutions with regard to interdisciplinary research and curricular innovation. Seventy-five percent agreed or strongly agreed that their school does a good job supporting interdisciplinary research and more than 80 percent say curricular innovation is strongly encouraged. However, a smaller proportion, just 57 percent of faculty, agreed or strongly agreed that their institution does a good supporting interdisciplinary teaching. This suggests an opportunity for a more explicit and sustained focus on interdisciplinary teaching among members.

Figure 9. Institutional Support for Interdisciplinary Research and Teaching
Please rate how strongly you agree/disagree with the following statements about your college/university.

- ● Strongly agree
- ● Agree
- ● Neither agree nor disagree
- ● Disagree
- ● Strongly disagree

Does a good job enabling interdisciplinary teaching
17%   40%   31%   12%

Does a good job enabling interdisciplinary research
27%   48%   15%   10%

Curricular innovation is strongly encouraged
35%   48%   17%

Does a good job partnering with private industry/corporations
27%   40%   27%   4%   2%
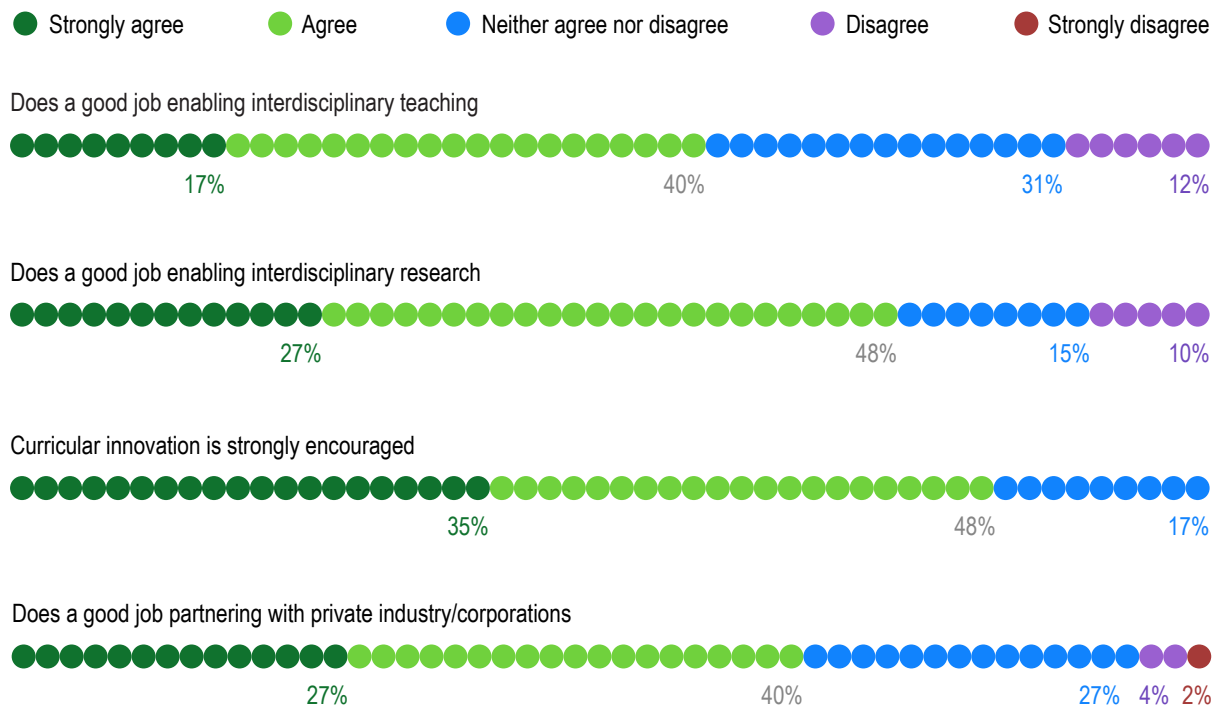
As previously noted, a significant proportion of members struggle with attracting dually-trained faculty with expertise that bridges public interest and technical fields. One alternative to new hires is finding ways to complement domain expertise in the classroom or research lab. A number of PIT-UN members have created innovative mechanisms to integrate technical or ethical expertise into courses that may not traditionally have them as key components. Examples of this "curricular diffusion" or "distributed pedagogy" approach include the Embedded EthiCS program at Harvard, which embeds philosophers directly into computer science courses. Stanford also offers an Embedded EthiCS program, wherein postdoctoral fellows develop curricular materials, assignments, and ethical modules for multiple undergraduate computer science courses. University of California, Berkeley created a Human Contexts and Ethics Toolkit, curriculum and case studies that can be integrated into technical or data-science courses. They and other PIT-UN members received funding via the Mozilla Responsible Computer Science Challenge, which sought to incentivize better integration of ethics into undergraduate computer science training, with strong industry support.

The Collaboratory at Columbia University promotes interdisciplinary teaching, with a specific focus on embedding data or computational science into nontraditional fields and embedding business, policy, cultural, and ethical topics into data or computer science curriculum. The Collaboratory offers seed funds to teams of faculty, including one with data science expertise and one with domain expertise, to develop and test curriculum, spurring the creation of 32 new classes in 11 schools in the last five years. All the examples noted here provide mechanisms for marrying public interest themes with technical training, beyond a single course and in the absence of dually trained experts who can go it alone.

Universities also have an opportunity to draw on existing resources that are not exclusively PIT-oriented, as they look to nurture new types of courses and teaching. As one example, Virginia Tech's Center for Teaching & Learning offers access to the Project-Based Learning Institute to support faculty in the development of experiential-based courses generally. They also award faculty prizes for project-based teaching, including resources to present their work at relevant conferences. Targeted recruiting of faculty who may be less engaged in this type of teaching, like Engineering or Computer Science, may help expand disciplines engaged in experiential learning.

CROSS-INSTITUTION CURRICULAR SUPPORTS

Curricular innovation is one area where we unearthed a wealth of resources developed by faculty for use by colleagues and peers. We summarize some of the open access resources in Table 5, and note the opportunity for a central resource like Howard University's PIT Case Study platform to continue to integrate these alongside other tools. These open access resources, which range from complete syllabi to recommended readings to focused case studies, may help faculty modify existing courses to integrate more diverse perspectives as well as more public interest technology themes. This also represents an area where PIT-UN could elect to prioritize the development of even more new, shareable resources that address specific needs, such as anti-bias, race and social justice, and community-engaged research methods.

Table 5. Open Source Curricular Resources

Resource	Institutions	Description
Teaching Public Service in the Digital Age	Harvard Kennedy School; Canada School of Public Service; Carleton University; Cambridge University; University of Konstanz; Civil Service College Singapore; Tallinn University of Technology; University of Waterloo	• Identified 8 core competencies in Digital Era skills for public sector leaders. • Published open access Masters level syllabus and teaching materials [Link]
Public Interest Technology Case Study platform	Howard University (lead); Open to all PIT-UN members for submissions	• Provides narratives, teaching strategies, and curriculum resources related to public interest technology [Link]
Case Studies in Social and Ethical Responsibilities of Computing	MIT	• Peer-reviewed cases for use in undergraduate instruction; Includes learning objectives and suggested activities [Link]
Public Interest Technology Open Educational Resources	City University of New York	• Four modules and associated lectures on project management, engineering ethics, 3D printing, and Open Source coding [Link]
Tech Policy Lab Instructional Case Studies	University of Washington	• Case studies to enhance tech policy fluency, for use with multiple audiences — policymakers to undergraduates [Link]
Human Contexts and Ethics Toolkit	UC Berkeley	• Theories that describe how technology and society relate [Link]
Critical Race & Digital Studies Syllabus	Center for Race & Digital Studies (Affiliated with NYU)	• Syllabus of readings by people and scholars of color focused on how race has shaped our digital world [Link]
Ethics, Society & Technology Hub — Case Studies	Stanford	• Syllabi for wide range of socio-technical courses across Communications, Management, Computer Science, and other fields [Link] • Case studies [Link]
Teaching Responsible Computing Playbook	[Multiple Institutions — Created as part of the Mozilla Responsible Computer Science Challenge]	• Extensive archive of resources including detailed roadmaps and case studies on how to integrate ethics, justice, service learning, industry partners into Computer Science education; Also includes teaching materials [Link]

ENABLING RESEARCH

It is important to consider the extent to which members are investing in resources that support faculty-led research. Ultimately, these investments are key to diversifying funding resources and supporting student education at the graduate, as well as undergraduate, level.

Institutional infrastructure that enables socio-technical research, like research centers, abound. We identified well over 400 research centers or major initiatives across members devoted to related fields of research. These inevitably vary greatly in size and resources, but generally function to sponsor and promote related research. Many also provide research seed grant funds, recognize expertise and foster community through faculty fellows programs, workshops, and other types of events, or provide supports for students via internships, co-curriculars, or student fellows programs.

Interestingly, use of the term "public interest technology" was exceedingly rare — almost nonexistent — in the naming of research centers and initiatives. The new Public Interest Tech Lab at Harvard, supported by a recent $3 million grant from the Ford Foundation, was the only example of a unit that will function like a research center or institute and bears the term.[9] As mentioned earlier, it may be that public interest working groups and learning communities, which are still in their early stages, eventually evolve into dedicated centers rather than program or integrative "initiatives." However, it may also be the case that the term will only take hold within the research enterprise at universities if similar, significant multi-year grants are forthcoming.

Figure 10. Public Interest Technology Research Centers and Institutes; Word Cloud of Titles
Note: "Center" and "Institute" removed

Consortium models also help to foster research relationships across, rather than just within, PIT member institutions. Georgia State University and GeorgiaTech created a Southeast Region Public Interest Technology Fellows program to bring together social scientists from Georgia State with technologists from GeorgiaTech to "address social challenges through computing." CITRIS (Center for Information Technology Research in the Interest of Society) and the Banatao Institute fosters a research community across the University of California campuses of Berkeley, Davis, Merced, and Santa Cruz. Faculty leads exist at each institution, and faculty can apply for CITRIS Principal Investigator status, fostering a cross-institution community. The Internet of Things (IOT) Collaborative is a jointly run center led by

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9   We note the challenge of relying too much on naming conventions. We did explore the function of units that employ the term public interest technology, rather than just relying on use of the terms "center" or "institute." NYU has a Public Interest Technology Institute, which is a two-week bootcamp for early and mid-career faculty. Stanford also has a Public Interest Technology Lab, which is a student-led organization expressly focused on helping students explore the field and engage in experiential learning and co-curriculars.

faculty at Case Western Reserve University and Cleveland State University to tackle smart city projects.

Industry engagement also represents a significant opportunity for PIT-UN members, as industry partners can provide career pathways for students, sponsorship supports for research, and complementary technical expertise and tools. Two-thirds of members believe their institutions do a good job partnering with industry [Figure 9.] Research collaborations offer one avenue for partnership. UC Berkeley and University of Illinois at Urbana-Champaign jointly manage C3.ai Digital Transformation Institute, which was established in 2020 together with multiple other universities, C3 AI, and Microsoft. It provides funding for visiting researchers, research seed funding to consortium members, a data analytics platform, and awards for formation of new undergraduate and graduate courses in Digital Transformation Science including topics like ethics, privacy, AI, and IOT techniques.

Finally, we note that three quarters of PIT-UN members had reported providing seed grants to foster interdisciplinary research collaborations [Table 5.] Our team identified relevant seed grants among fewer than half of PIT-UN members, which suggests there may be limited publicly available information about these types of resources. Multiple respondents noted the importance of the PIT-UN Challenge Grants as an important mechanism for engaging faculty and raising the profile of the field. It may be the case that the Challenge grants complement existing programs, though our research suggests it may be filling tailored seed funding gaps for many members.

STUDENT PROGRAMS AND INFRASTRUCTURE

PIT-UN advises members to invest in interdisciplinary curriculum and programs, foster experiential learning, and provide clear career pathways for the students they serve. As part of the landscape scan, we examined these themes, while also looking more broadly at the full array of student offerings and programs to understand thematic strengths and gaps.

DEGREE PROGRAMS AND CREDENTIALS

Student educational offerings related to public interest technology exist in abundance across the member network. Our search yielded more than nearly 220 degrees or specialized credentials at the graduate level and nearly 200 for undergraduates.

As previously noted, PIT-UN members are heavily invested in data science education for both graduates and undergraduates, via degree programs, minors, certificates, and concentrations. The word clouds [Figures 11 and 12] provide a sense of how commonly data is emphasized within graduate and undergraduate educational offerings.[10]

Some schools provide dual degrees or other opportunities for related specialization, such as Florida International's MS in Data Science with a concentration in Public Policy Analysis, Berkeley's NSF-funded doctoral program in Environment and Society: Data sciences for the 21st Century, Penn State's MS in Spatial Data Science, or Nazareth College's BS in Ethical Data Science.

"Public Interest Technology" degrees are almost nonexistent, and there are no related minors or certificates. The sole exception to date is the Masters of Public Interest Technology created by Arizona State University.

Minors, certificates, and concentrations, here referred to more generally as credential programs, are an area of tremendous innovation and relevant lessons. In total, the landscape scan yielded over 180 such offerings for graduate and undergraduate students across 41 PIT-UN members. Even institutions that do not offer degree

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10   The authors searched for undergraduate and graduate degrees, concentrations, certificates and minors that were either a) associated with the fields most commonly cited as technical foci of the PIT-UN members (e.g., Data Science, AI, Cybersecurity, GIS) or b) clearly demonstrating a link between socio and technical fields (e.g., Engineering & the Public Interest, Technology & Society). Graduate programs that emphasize data skills in related fields, such as Urban Studies, may also have been included. Computer Science was not included as a "PIT degree," unless it was a hybrid degree or made an explicit connection to policy or people. For future iterations of this report, it may be important for the PIT-UN community to come to common agreement as to what constitutes a relevant student degree or credential.

Figure 11. PIT-UN Members: Undergraduate Academic Program Foci

Figure 12. PIT-UN Members: Graduate Academic Program Foci

programs in related disciplines, like data science, are devising relevant credential offerings. Some universities are using these to allow students to acquire important skills, without having to add an entire degree, while signaling expertise to employers. Common emphases in such offerings more generally include science, technology and society, data science or analytics, or specific skills like GIS or cybersecurity. Penn State offers an [Engineering and Community Engagement](#) undergraduate certificate, which provides recognition that students have gained "proficiency in design, research, and application of appropriate technologies for use in serving communities in the US and abroad while stressing an awareness of the cultural context of such engineering activities." Community collaboration and ethical considerations are emphasized.

As previously noted, there is a dearth of both degree and credential programs that explicitly reference ethics or race and social justice alongside technical expertise. UC Santa Cruz offers one example of the latter, a Science & Justice graduate certificate, which draws social, natural, and computational scientists and engineers, while the University of Arizona provides a Human Rights and Technology graduate certificate. Still, specialized offerings with this type of focus appear to be the rare exception.

A significant number of survey respondents give their institutions poor marks with regard to "making it easy for students to cross-register for courses." This suggests at least some schools need to remove barriers to multi-disciplinary learning — which is particularly important in the context of public interest technology — whether by creating interdisciplinary degree or credential programs such as those noted or by better facilitating cross-registration.

EXPERIENTIAL LEARNING

Experiential learning is also one of the five areas PIT-UN members have been asked to prioritize. Based on our scan of related programs across the member network, it is clearly a source of innovation and investment for PIT members. Survey respondents revealed the myriad ways their institutions seek to provide experiential learning opportunities for students, from 'low stakes' efforts like using real-world data in courses to those that typically require more staff infrastructure, such as clinics and real-world test beds [Figure 13].

Figure 13. Experiential Learning Opportunities
At your institution, how common are the following experiential opportunities for students engaged in public interest technology learning?
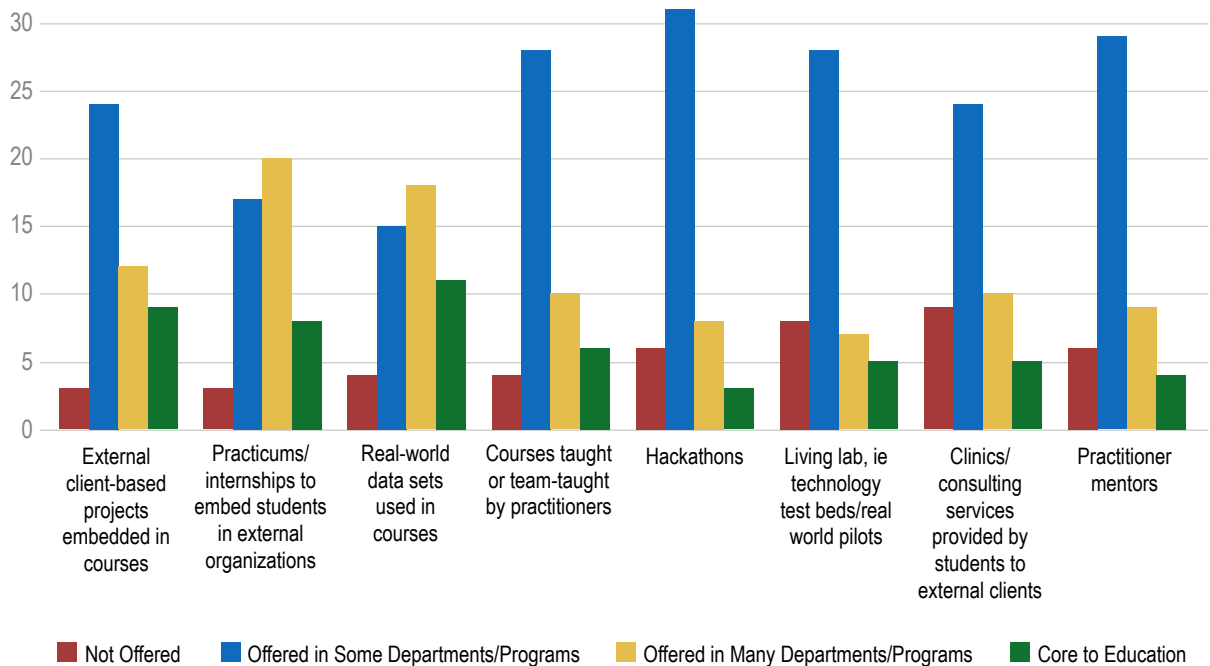
In all, we identified nearly 120 experiential learning programs across member institutions, spanning a wide range of schools and colleges, as well as institutes and centers. It is clear that there is no prescribed "home" for these types of efforts. Multiple law schools lead related efforts, such as the joint Boston University/MIT Technology Law Clinic, Harvard's Cyberlaw Clinic, UPenn's Detkin Intellectual Property and Technology Legal Clinic, and Georgetown's Iron Tech Lawyer Invitational, which invite student teams to showcase legal tech and data analysis tools they have developed to improve access to justice. Others relate to explicit technical domains, like the Nittany AI Alliance at Penn State or the Data Science for Social Good program at Carnegie Mellon.

Practitioner mentorship and fellowship programs also help bring perspective from the field to campus, and even into the classroom. Boston University's Spark! program, the university's experiential learning program for students in computational disciplines, created compensated Experts-in-Residence roles to engage practitioner mentors for student teams who possess both technical and domain expertise in areas like criminal justice, housing, elections, or human trafficking. The landscape scan yielded practitioner "fellowships" or "residencies" at about a dozen member institutions. These vary greatly in duration, structure, compensation, and function, with thematic foci ranging from AI to disinformation to race and technology. Princeton's Center for Information Technology created a forum for domain experts and policymakers to share real-world challenges they are confronting. Dubbed "Tech Policy Case Studies," the sessions bring real-world perspective to discussion of timely issues.

Internships and practicums, which may serve fewer students overall than clinics or other team-based approaches, are also an important way to support experiential learning and professional development. Indeed, they appear to be the second most widely used mechanism to provide students with real-world learning opportunities. Our landscape scan only revealed PIT-oriented internship programs at 18 member institutions, though similar to research seed grants, it may be these are less likely to be publicly visible.

We also identified a range of physical and cyber resources that students and faculty can leverage for hands-on learning, like living labs or real-world test beds. University of Chicago and partners have long hosted the Array of Things, a sensor network that collects real-time data on Chicago's climate, air quality, noise, and other factors. [It is now part of a larger multi-city effort with Northwestern University, University of Illinois, and others.] The Rochester Institute of Technology's community-based LiveAbility Lab is a physical test bed for new solutions that improve access for individuals with varying abilities. It was created in partnership with the AI Sigl Community, which serves adults and children with special needs. William & Mary's McGlothlin Courtroom is a test bed for courtroom and legal technology, like virtual reality, holographic, and 3-D evidence. The University of Arizona built CyberApolis, a virtual city inhabited by 15,000 detailed personas that acts as a realistic test bed for student learning related to cyberoperations.

Using real data sets, embedding client-engaged projects into capstone courses, or setting up practitioner mentorships may be desirable paths for schools that want to increase experiential learning opportunities, but lack resources for full-scale clinics or test beds of the scale noted above. As one example, the University of Washington's Information School requires client-based capstone projects as part of its undergraduate Informatics degree.

Given the wealth of programs related to experiential learning, PIT-UN may want to consider whether this is an area where it could foster a dedicated community of practice and focused convenings. As one example, EPIC-N (Educational Partnerships for Innovation in Communities) is a national network of universities, primarily though not exclusively public, that forge experiential learning agreements with local governments. EPIC-N helps to facilitate knowledge sharing across members, including best practices in MOUs and other operational elements necessary for these types of partnerships to be of mutual benefit.

STUDENT CLUBS

Student clubs provided a fascinating degree of insight into the strength of "bottoms up" student interest. Our team identified over 125 related student clubs across nearly every member of the network. Some members had an extraordinary array of student-led efforts, based on a scan of their student club databases.[11] Even more surprising was that a number of student clubs are structured as experiential learning programs, created for the purpose of connecting student talent to outside organizations to provide voluntary skills-based services in fields like law, data science, or engineering.

With the support of PIT-UN, student clubs are now forming that are explicitly focused on public interest technology. Olin College's PInT [Public Interest Technology Clinic] is one such student-led effort. Students at Olin devised a robust strategic plan, are forging new experiential learning partnerships, and lead a summer fellowship program that

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11   Our search inevitably yielded student clubs that may not currently have active student leadership. Defunct clubs may still be referenced in central administrative listings. Nevertheless, outreach to or coordination across student clubs may yield a powerful set of allies for PIT leaders, particularly for institutions that are newer to the field of public interest technology.

places five Olin students with public interest organizations. Howard University is launching a similar student-led club to "host PIT activities such as hackathon and share PIT student resources such as career, collaboration, and research opportunities," joining the ranks of the student-run PIT Lab at Stanford and PIT@Penn.

The extraordinary demonstration of student leadership suggests additional opportunities for PIT-UN and its member institutions to deepen student engagement on campus by nurturing connectivity across relevant clubs like Engineers Without Borders, the new PIT enterprises, and the many clubs that emphasize thematic interests (e.g., data science, cybersecurity, tech law.) Members also have an opportunity to engage student clubs that foster community among underrepresented groups, like the student chapters of the National Society of Black Engineers, Society of Hispanic Professional Engineers, or Women in Cybersecurity. Indeed, half of survey respondents reported their institutions already use student clubs as a way to nurture engagement in public interest technology among underrepresented groups, suggesting an opportunity for the remainder.

Given the overwhelming evidence of student-led initiatives, it may be time for member institutions and the PIT-UN network to adopt a values-driven "nothing about us without us" approach, in part by integrating student voices and perspectives into decision-making via student delegations at conferences and representation on working groups.

COURSES

The creation of new courses is a key priority for the Network. Eight-five percent of survey respondents noted that new courses were one of the primary ways they were raising awareness of public interest technology at their institutions. Indeed, it was the most common pathway selected by members, which suggests that it is an easy entry point for institutions of any size, particularly given the complexity of creating new degree programs.

Survey respondents were also asked to share an illustrative public interest technology course and describe key words they might use in writing a relevant course description. The emphasis on technology and ethics is readily apparent [Figure 14], as well as justice, further reinforcing these as strategic priorities for members and for the field more generally. It may be that a natural step from these ethically and justice-centered courses is degrees, minors and certificates that explicitly highlight related skills.

Figure 14. New PIT Courses
If you were writing a description for a new course relevant to public interest technology, what terms would you be sure to include?
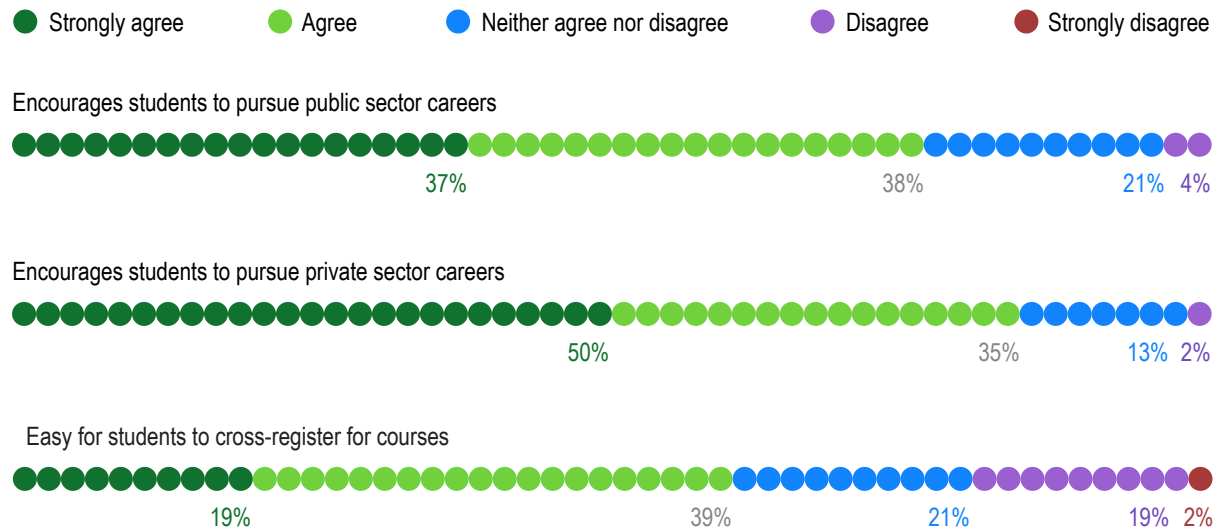
CAREER PATHWAYS

The ultimate objective of PIT-UN is to cultivate a new generation of public interest technology professionals. As undergraduate and graduate students acquire a new set of skills, universities have an opportunity to introduce them to a wide array of professions and professional pathways. NYU and multiple partners recently hosted A Better Tech, a virtual convention and career fair that brought together practitioners from a wide range of fields with researchers and students for panel discussions, hackathons, networking, and career talks.

This type of forum that breaks down silos and engages public and private sector professionals is particularly important, as members currently perceive their institutions as being more likely to encourage private than public sector career paths. Fifty percent "strongly agree" their schools do a good job encouraging students to pursue private sector jobs, relative to 38 percent who strongly believe the same for public sector roles. This is noteworthy insofar as PIT-UN is equally interested in both tracks and recognizes the talent shortage facing government and nonprofit sectors.

Figure 15. PIT Career Paths
Please rate how strongly you agree/disagree with the following statements about your college/university.

● Strongly agree ● Agree ● Neither agree nor disagree ● Disagree ● Strongly disagree

Encourages students to pursue public sector careers

37%   38%   21% 4%

Encourages students to pursue private sector careers

50%   35%   13% 2%

Easy for students to cross-register for courses

19%   39%   21%   19% 2%

Fifteen PIT-UN members also offer relevant education programs devoted to working professionals, either in the form of structured continuing education or training, or for-credit professional certificate programs. These include programs in fields like data science, cybersecurity, and GIS, as well as those for specialized roles like Pepperdine's Professional Certificate in Leading Smart Communities, which focuses on government technology (govtech.) By providing opportunities for lifelong learning, they empower working professionals to acquire new skills and potentially enter into new fields. These types of programs may also provide a valuable and complementary revenue source for PIT-UN members.

DEFINING THE FIELD

As we noted at the beginning of this report, the fields that comprise public interest technology are flourishing. There is emerging consensus about the discrete public interest and technical disciplines and expertise that universities are engaging in their PIT programs. Here we delve deeper to understand whether the term has taken hold, and how members define public interest technology more generally.
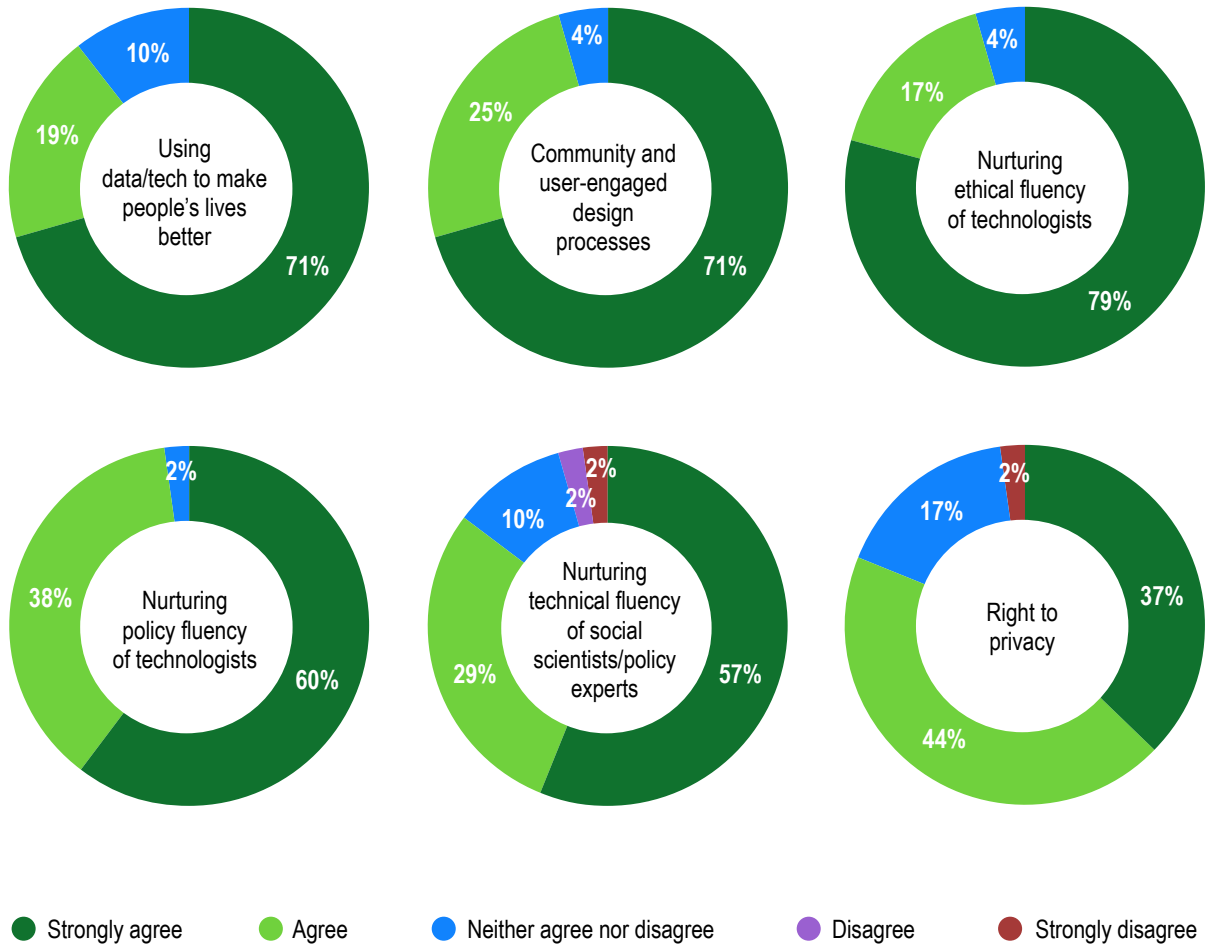
CONCEPTIONS OF PUBLIC INTEREST TECHNOLOGY

The term public interest technology has not yet become part of the academic lexicon. Among the more than 1,300 related programs, degrees, activities, centers, and other types of relevant resources we identified, just 28 use the term public interest technology in the naming convention.

While the term is not common, there does appear to be strong agreement among members that public interest technology is about: 1) nurturing the ethical fluency of technologists, 2) using data and technology to make people's lives better, and 3) community and user-engaged designed processes. More than 70 percent of survey respondents strongly agreed that each is a core premise of public interest technology.

Figure 16. Core Premise of PIT
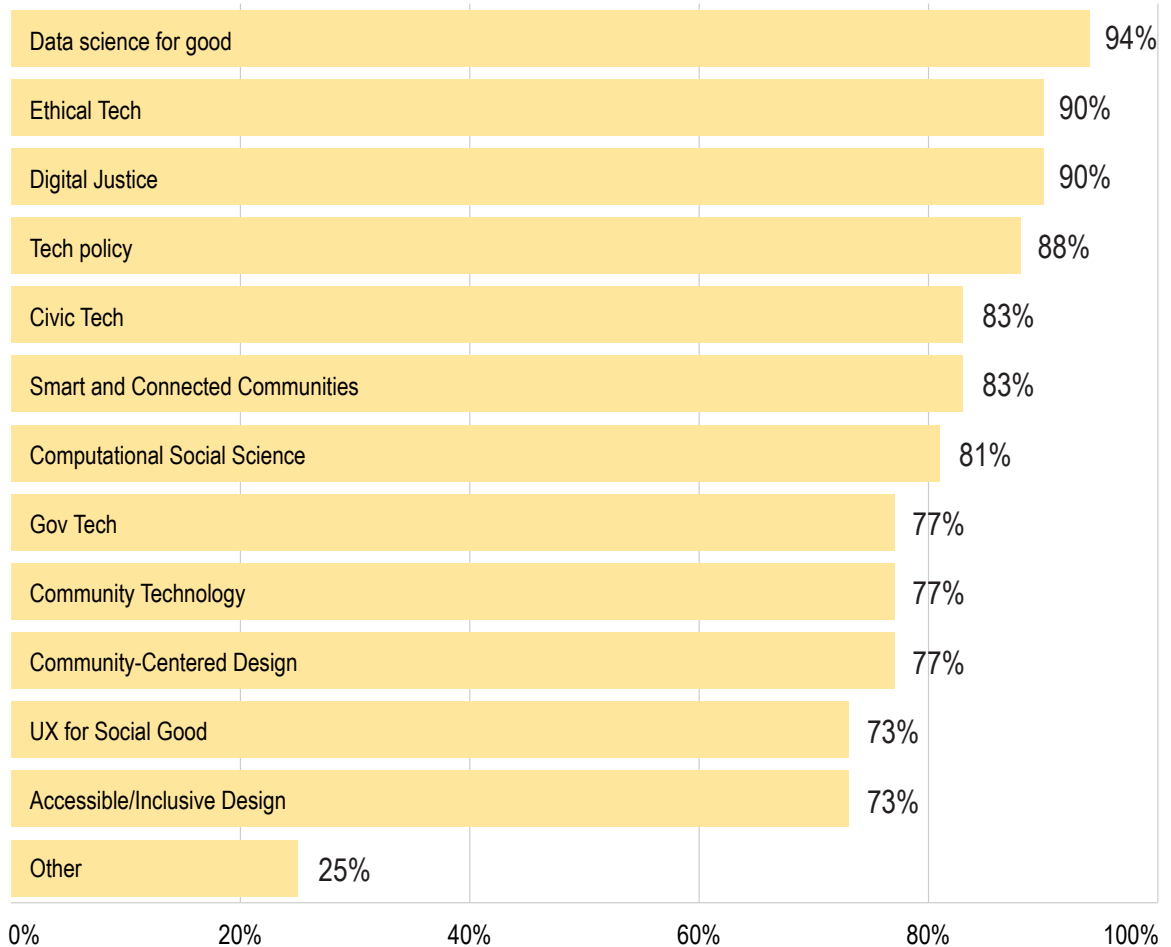*Please rank how strongly you agree/disagree that each of the following is a CORE premise of public interest technology.*

Legend: Strongly agree (dark green) · Agree (light green) · Neither agree nor disagree (blue) · Disagree (purple) · Strongly disagree (dark red)

Yet in spite of this agreement about the main thrusts of the field, there is limited agreement about what it is not. Survey respondents are much less likely to perceive the right to privacy as a central tenet and appear more mixed on whether the field is about nurturing technical capacity among policy experts and social scientists. When asked what related fields are included within PIT, respondents essentially answered "all of the above"…and then some [Figure 17.] Among the "other" responses, a wide range of yet more fields were referenced, including biotech, environmental justice, critical race and digital studies, human-machine connections, AI for good, data ethics, law, and humanities approaches to technology.

Figure 17. PIT-Related Fields
Which of the following fields do you consider part of public interest technology? [Select all that apply]

Field	Percentage
Data science for good	94%
Ethical Tech	90%
Digital Justice	90%
Tech policy	88%
Civic Tech	83%
Smart and Connected Communities	83%
Computational Social Science	81%
Gov Tech	77%
Community Technology	77%
Community-Centered Design	77%
UX for Social Good	73%
Accessible/Inclusive Design	73%
Other	25%

Our findings continue to suggest the field of public interest technology is at risk of remaining nebulous, as has been discussed in prior reports. As one survey respondent shared: *"Even as someone whose work is at the intersection of data science and public policy and is deeply committed to improving society with technology (and protecting against technological harms), I find that (at least thus far) PIT tends to act more as a label that many universities want to get behind than as a coherent concept that involves a shared language and structural efforts to produce interdisciplinary community."*

As the field of public interest technology matures, it may become important to delve deeper into the opportunities identified here, namely centering ethics, race and justice, and community engagement in technical education, and come to common agreement about what the future of the field looks like. Focusing future workshops and research into how to embed ethical training effectively across technical curriculum, and best practices in community and user-engaged design processes would be time well spent. And both provide a rich forum in which the PIT-UN community might emphasize anti-racist and truly inclusive design.

LOOKING AHEAD: LESSONS FOR MEMBERS

A number of lessons emerged from this comprehensive scan which may be useful to PIT-UN members as they evaluate future investments and expand their public interest technology initiatives.

CONTINUE TO BUILD INSTITUTIONAL INFRASTRUCTURE

■ **Conduct a comprehensive scan of your institution's related activities and programs.**
Current members can use the individual activity and program inventory developed for this report to home in on strengths as well as gaps in both education and research, and identify areas for growth. New members could use the categories detailed in Table 1 to conduct their own scan.

■ **Form a central unit or working group responsible for fostering a shared vision across your institution and catalyzing new interdisciplinary collaboration.**
Half of current PIT-UN members have not yet built related relationship or governance infrastructure like working groups and steering committees. All members should be mindful of including experts beyond technical fields, particularly in ethics, racial justice, community engagement, or experiential learning, as well as disciplines like law, policy, and journalism, as relevant to their institution. Fields like Social Work, Public Health, and Sociology have a long history of community-engaged research, justice and inclusion, and decades of investment in remedying inequities and building (or restoring) trust among vulnerable populations.

■ **Foster community through convenings and the PIT- UN Challenge calls for proposals.**
A well-publicized call for proposals, targeted to a mailing list of prospective faculty allies, provides a visible, meaningful invitation to engage. Annual convenings also provide venues to celebrate faculty and student research, and build bridges across departmental silos.

■ **Create a fundraising plan.**
Universities will need to diversify funding sources for PIT activities if the field is to endure. Work with Development, Sponsored Program offices, Corporate Relations, and Foundation Relations teams to identify funding sources to support research or research centers, as well as experiential learning and student internship programs. Tuition revenue, via certificate and continuing education offerings as well as standard degrees, could also be considered.

RECRUIT AND SUPPORT A DIVERSE STUDENT POPULATION

■ **Understand the baseline and set targets.**
Examine demographic data on students currently engaged in relevant degree programs, certificates, and minors identified and prioritized via the landscape scan. Look for successes as well as failures in enrolling and retaining women, nonbinary students, and underrepresented minorities. Define goals and agree to a process to assess progress.

■ **Broaden participation in sustained and sustainable ways.**
This report lays out multiple potential avenues for universities to engage underrepresented groups in PIT initiatives and programs. The most frequently employed strategies are targeted student and faculty recruiting and experiential learning, while other mechanisms like partnerships with community colleges and targeted financial aid are still relatively rare. Foundation and corporate grants and gifts could complement institutional resources and programs designed to increase representation. Employer partnerships could be used to create mentorship and career pathway opportunities.

- **Foster a culture of inclusion so underrepresented students are adequately supported, and all students are learning in a bias-free environment.**
  Invest in professional development and anti-bias training for faculty and staff to foster an inclusive culture. Systematically evaluate syllabi to respect and center diverse perspectives and revisit teaching and out-of-classroom engagement methods to further mitigate bias and reduce stereotype threat.

- **Evaluate what is working, and where barriers endure.**
  Use the steering committee or subcommittees to survey students to understand major barriers and challenges, regularly evaluate progress toward defined goals, and invest in and contribute to the public (and published) evidence-base of effective practices. Share and invite lessons from across the PIT-UN network via public sessions that also engage students in dialogue.

REFINE/DESIGN PIT DEGREE PROGRAMS AND CREDENTIALS

- **Evaluate existing undergraduate and graduate degree programs to determine which to 'retrofit' and where to 'build new.'**
  The landscape scan should yield a comprehensive array of degree programs, minors, certificates, and concentrations on which to build. A course scan may also yield insight into potential building blocks. A steering committee could help prioritize and shepherd formation of new offerings, and identify opportunities to inculcate PIT themes and cases into existing programs.

- **Create incentives for faculty to integrate PIT themes, via readings, case studies, and experiential learning, into existing courses.**
  Members can incentivize co-taught courses, integration of relevant experts as guest lecturers, or systematic revision of syllabi. Multiple open-source resources and examples of curricular diffusion incentive programs are referenced in the report.

- **Consider creation of 'credential' programs that explicitly reflect priority skills in ethics, race/social justice, anti-bias, and community engaged methods.**
  Very few members currently emphasize these skills in the naming of minors, concentrations, or certificates, and just one offers a related degree program. Consider creation of new credentials that signal specific skills to employers.

- **Continue to invest in experiential learning activities that foster deeper understanding of real-world challenges.**
  Experiential learning programs abound, so the opportunity here is for members to scale these efforts across multiple departments and academic programs. Institutions could migrate from low-stakes efforts like integrating real world data sets and capstone projects in select courses to staffed cross-departmental/cross-college experiential learning programs.

APPENDIX

Definitions: As part of the comprehensive landscape scan, a team at Boston University searched publicly available sources, including university, college and center websites, student club databases, degree catalogues, and press releases for each of the 43 members of the Public Interest Technology University Network between June and September, 2021. Future teams may, of course, elect to scrutinize fewer categories, use different definitions or techniques, or request that members conduct this type of scan independently.

Institutional	Research Seed Grants	Competitive internal funding to support new research projects *(PIT Challenge not included as it applies to all members.)*
	Research Centers	Ongoing formally recognized research unit; May have Center or Institute in the name (though that is not sufficient for inclusion); Typically includes faculty leads/co-leads, faculty affiliates, explanation of research foci or key projects, and hosts events. May also lead student programs, certificates or other forms of revenue generating activities.
	Research Initiatives	Research effort within a center or institute, or which is otherwise publicly acknowledged by an institution but may lack the formal governance infrastructure of a center or institute.
	Interdisciplinary Unit/Program	Structured program, hub, alliance or network designed to bridge various disciplines within a single institution; Not an academic department or college
	Research Consortium	Cross-university research network or hub
	Dissemination	Communication channels such as podcasts or journals; May include large scale, repeating public engagement activities
	Tools/Resources	Data platforms, physical assets like buildings, living/learning labs or other types of services for faculty or students which help to enable research
Faculty-Centric	Academic Fellows	Designation to recognize faculty affiliation outside their home department
	Teaching/Curricular Supports	Resources or initiatives that enable teaching, including case studies, sample syllabi, funds to catalyze interdisciplinary teaching
	Continuing Ed/ Professional Dev	Training that is tailored to faculty
Student-Centric	Academic Fellows	Designation to recognize student affiliation with a particular center or institute
	Student Clubs	Organizations created and led by students for students
	Co-Curriculars	Events or seminars that occur outside of regular course structures
	Experiential Learning Programs	Programs that integrate real-world projects into campus learning, particular within structure of courses
	Internships/ Practicums	Short-term employment or educational opportunities for students with external organizations or on campus units; Typically paid roles
	Undergraduate Concentrations	Focus area within an undergraduate major. Some variation in use of the term "concentration"
	Undergraduate Certificates	Certificate or other formal credential provided to an undergraduate student at the completion of a program of study
	Undergraduate Degrees	Degree conferred on an undergraduate student at the completion of a program of study
	Master's Degrees	Master's degree conferred on a graduate student at the completion of a program of study
	Doctoral Degrees	PhD conferred on a graduate student at the completion of a program of study
	Graduate Concentrations	Focus area within a Master's or Doctoral degree program
	Graduate Certificates	Certificate or other formal credential provided to a graduate student at the completion of a program of study
Student K-12	High School Program	Educational programs, camps or workshops designed expressly for K-12 students
Practitional-Centric	Practitioner Fellows	Designation to recognize affiliation of a working professional with a particular center, institute or interdisciplinary unit
	Professional Certs	Certificate or other formal credential provided to a working professional at the completion of a program of study
	Continuing Ed/ Professional Dev	Structured course or training program for working professionals; No associated credential referenced

PUBLIC INTEREST TECHNOLOGY UNIVERSITY NETWORK

Arizona State University

Boston University

Cal Poly State University

Carnegie Mellon University

Case Western Reserve University

Cleveland State University

Columbia University

Cornell University

Florida International University

George Washington University

Georgetown University

Georgia State University

Georgia Institute of Technology (Georgia Tech)

Harvard University

Howard University

Miami Dade College

Massachusetts Institute of Technology (MIT)

Nazareth College

New York University

Olin College of Engineering

Pardee RAND Graduate School

Pepperdine University

Princeton University

Rochester Institute of Technology

San Jose State University

Stanford University

The City University of New York

The Ohio State University

The Pennsylvania State University

The University of Chicago

University of Arizona

University of California, Berkeley

University of California Santa Cruz

University of Illinois at Chicago

University of Michigan

University of Pennsylvania

University of Texas at Austin

University of the South - Sewanee

University of Virginia

University of Washington

Virginia Tech

William & Mary

Worcester Polytechnic Institute

Member Institutions as of 2021

The Faculty of Computing & Data Sciences (CDS) at Boston University is a transdisciplinary, degree-granting academic unit that lives outside the typical organization of a university into schools, divisions, and departments. A tenure home for truly interdisciplinary faculty, CDS provides undergraduate and graduate students with the necessary agility to steer their education and training in a way that leverages their passion for discovery, innovation, and real-world impact.

The Boston University Initiative on Cities (IOC) serves as a university-wide urban center that marshals the talents and resources of the social, natural, computational and health sciences across Boston University in pursuit of sustainable, just and inclusive urban transformation. The IOC leads research in, on and with cities, hosts critical conversations, and creates experiential, place-based learning opportunities for students.