

## Increasing Productivity by Broadening Participation in Scientific Software Communities

**Interviewees:** [Mary Ann Leung](#) (Founder and President, Sustainable Horizons Institute)

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**Interviewer:** [Lois Curfman McInnes](#) (Senior Computational Scientist, Argonne National Laboratory)

Submission to the [2020 Collegeville Workshop](#)

July 14, 2020

**Introduction:** Numerous studies have shown that diverse organizations, teams, and communities perform more creatively and effectively—and thus are more productive. While some efforts are already under way to broaden participation in high-performance computing (HPC) and computational science and engineering (CSE), we observe that our communities could benefit by increasing emphasis on sustainable strategies to advance diversity and inclusion.

**Lois:** Mary Ann and Damian, many thanks for providing your perspectives as leaders who are working to broaden participation of under-represented groups in high-performance scientific computing. I am hoping to learn more about how individuals and groups can take steps forward within our own spheres of influence to broaden participation and thereby to help the community as a whole advance in productivity.

**Question: What are your backgrounds?**

**Damian:** My training is in computational fluid dynamics. As a consultant, educator, and researcher, I have long aimed to adapt leading-edge software engineering practices to computational science and engineering applications. I'm passionate about advancing development practices in modern Fortran. As an African-American, I see my adopting an underdog language as partly an extension of being outside the dominant culture in STEM fields. At a time 20 years ago when most people who were passionate about improving scientific software development were adopting other languages, I found that an ability to embrace difference and combat stigma along one obvious dimension, ethnicity, makes it feel natural to swim upstream or outside the mainstream along another dimension: programming language choice.

**Mary Ann:** My training is in computational quantum mechanics simulations on HPC systems. As a woman of color, a first generation scientist, and a non-traditional student, I found the need for and became interested in diversity in science during school. I got involved in diversity initiatives and founded a few campus organizations focused on diversity and inclusion as well as career and professional development. I later ended up migrating my career to workforce development where my passion for the people side of science could be realized.

**Question: Why is broadening participation important for improving productivity – of software developers and high-performance computational science overall?**

**Mary Ann:** CSE/HPC developer productivity can be advanced by engaging a broader set of individuals for several important reasons. First off, CSE and HPC are inherently complex and require teamwork, creative solutions, and collaboration. Research indicates that diverse teams *are*

more innovative. Additionally, the workforce in general is becoming more diverse, and by not including members of underrepresented groups, we are missing out on potential new developers with new ideas and approaches.

**Question: What are some issues that organizations should consider in order to create effective environments where diverse community members can thrive?**

**Damian:** Recognize that institutions do not become homogeneous by chance and will not become heterogeneous by chance. Strongly deterministic forces shape the make-up of an organization. Equally strong, deterministic forces will be needed to counter patterns that have become sufficiently normalized as to seem unavoidable. Intentionality is key. Ultimately, an inclusive environment benefits all. Codes of conduct, for example, bring more people into full participation in discussions where they might otherwise be less likely to participate due to some experience of being disadvantaged relative to other participants. That experience of disadvantage could stem from simply being new to an organization or it could stem from being a member of a group that has experienced discrimination historically.

**Mary Ann:** Consider the following.

- Expanding Networks: One of the biggest challenges I see organizations struggle with is broadening their networks. Our current lack of diversity has resulted from the natural practice for people to use their own networks when looking for collaborators, students, post-docs, new hires, committee members, etc. So the BIG challenge is getting outside of those networks. But that's asking people to know what they don't know or reach people they don't know. So start small by finding people one or two nodes away so you can access new and hopefully more diverse networks. Even better, seek out people like Damian and organizations that have established networks with diverse communities, such as [Sustainable Horizons Institute](#) and the many other organizations out there.
- Recruitment vs. Retention: Many organizations start with a focus on recruiting; however, if organizations work only on recruiting, they will ultimately fail. The best recruitment is good retention. Without creating environments where everyone feels welcome, fully participates, and thrives, no amount of recruiting can achieve broad engagement of the potential workforce.
- Beyond Recruitment: It is important to think about diversity not just in terms of recruitment. Creating diverse workplace environments where there is currently little to no diversity requires a long view. It is important also to work on outreach, which can have a multitude of benefits. Not only can you develop relationships with groups of interest, you can also use outreach as an opportunity to learn more deeply about the unique features and needs of the community.
- Critical Mass vs. Integration: Another problem that organizations face is the critical mass issue. If there is a lack of or very little diversity in an organization, how can you increase diversity when starting at or near zero? No one wants to be the canary in the mine, testing out whether or not the environment is survivable; nor does anyone want to gather in the corner and be separate from the main group. There is an important balance between critical mass and integration. It is hard to be "the only one", yet working toward achieving critical mass also requires full integration in the community. The work we do at Sustainable Horizons intentionally focuses on mainstream communities where we try to balance critical mass and integration. The [Broader Engagement](#) program at SIAM CSExy conferences is an example of this approach and is described below.

**Question: What are some actionable steps that institutions, departments, and groups can take to broaden participation in research and development (including visitor/student programs, staff hiring, etc.)?**

**Damian:**

- Re-evaluate the criteria and processes used for hiring and advancement. Recognize that these criteria are not fully deterministic of future performance outcomes and probably exhibit correlation coefficients well below 1. When an organization recognizes a need for broader participation from underrepresented groups, it's an opportunity to re-examine the measures of merit and determine the extent to which they contribute to the intended outcomes versus simply aligning with organizational norms and reinforcing established patterns.
- Recognize that as organizations become more diverse, they will change. It will not be possible to engage people from a much broader set of backgrounds while continuing to operate largely the same way. New voices will lead the organization in new directions if empowered to do so. If not empowered, many will leave and the organizations will continue with business as usual.
- If you want greater participation of underrepresented populations, recruit where those populations are *not* underrepresented: women's colleges, historically black colleges and universities, tribal colleges and universities, and hispanic-serving institutions. Invest resources in collaborating with such institutions using internal research dollars.
- A few easy actions to begin:
  - Ask hiring managers to document what steps they will take to recruit a more diverse candidate pool and then later ask them to report on how they did towards their plans.
  - As part of documenting steps, have departments share best practices with each other to ensure that success begets success and proven ideas spread. Also publicly highlight and honor best practices.

**Mary Ann:** Develop strategies and action plans in these areas:

- Outreach
- Recruiting
- Hiring
- Retention
- Workplace culture
- Monitoring and tracking of data and activities

**Question: What are some actionable steps that organizers can take to broaden participation in community activities (such as workshops and conferences)?**

**Damian:** Part of broadening participation might involve establishing new roles that become part of the standard operational model in planning activities such as workshops and conferences. Conferences have steering committees, papers chairs, session chairs, and administrative roles. The process of filling these roles often relies heavily on the professional networks of those who have participated in the event in the past. In a world wherein it becomes the norm to be intentional about broadening participation, it could become routine to engage a person or organization in examining and expanding the networks of the conference planners beyond the usual suspects.

**Question: Can you provide some examples of successful efforts in diversity and inclusion?**

**Mary Ann:**

- A program that has helped [Berkeley Lab Computing Sciences](#) broaden their workforce is [Sustainable Research Pathways](#). Through this program the lab has brought almost 200 faculty and students from underrepresented backgrounds to the lab for research collaborations. Participants have strengthened their vision of themselves as scientists, clarified their career goals, decided to go to grad school, and improved their technical skills. Staff have expanded their research portfolios and learned that there are extremely capable and dedicated scientists at institutions they would have never considered. Much of the success is due to bringing “unusual suspects” to the lab and opening the eyes of staff researchers to possibilities.
- A good example of a strategic approach to workforce development is to start by taking stock of the current workforce environment and preparing a plan of action addressing recruitment, outreach, climate, culture, and retention. Sustainable Horizons has worked with a variety of organizations to conduct such studies. We start by gathering information and talking with people. We compile the information gathered, compare to national data, and make specific recommendations for how to move towards more diversity and inclusion.
- An example of balancing critical mass and integration is the [Broader Engagement](#) program at the SIAM CSExy conferences. Through this program, we fund students and professionals from diverse backgrounds to attend the conference and participate in the full technical program and community. We also organize special events for the group designed to build community and provide mentoring as well as career, professional, and leadership development. Of particular success have been the [Guided Affinity Groups](#). These small learning groups meet virtually before the conference, then each morning over breakfast during the conference. The leaders are recruited from the SIAM CSE community. Each morning they discuss what sessions the participants should attend in their topical areas, answer questions, and provide other guidance. The feedback on these sessions has been very positive from both participants and leaders. At the end of the conference, each group presents what they learned to the whole group.

**Question: Any final comments?**

**Damian:** Broader participation results not just from bringing people from underrepresented populations into the settings where they are missing. Consider doing the reverse: encourage staff to spend time at institutions where underrepresented groups make up a majority: minority-serving institutions or institutions in Africa and South America, for example. Collaborations and visiting appointments in such settings will generate new research directions and will create new professional networks, enabling organizations to more fully leverage the talent pipeline. A common response to underrepresentation is to blame the pipeline, but this cannot fully explain many organizations’ workforces because too often the percentage representation of the underrepresented groups falls far below the percentage in the pipeline.

**Mary Ann:** The difference between diversity and inclusion can be described with this analogy: Diversity is like being asked to the party, where inclusion is being asked to dance. What good is it to show up but not actually participate?