NC STATE

Post COVID-19 Innovation Task Force on Research

With the establishment of the university's 2021-2030 strategic goals, the Post COVID-19 Innovation Task Force Steering Committee focused its charge on forming initiatives that the university should continue in the near term, while recognizing that those initiatives will most likely need to be revisited and better aligned with the new strategic goals over time.

The Task Force on Research was specifically charged to develop proposals to improve university effectiveness within research and innovation by 1) leveraging "lessons learned" over the past year; and 2) identifying potential adaptations at the university level that may hold potential for improving future performance, effectiveness, and operations.

The Task Force took a broad view of the research enterprise at NC State and focused its work around four themes: people, innovation, infrastructure, and process. For people, we considered issues of recruitment, promotion, retention, and establishing collaborations; for innovation, we focused on interdisciplinary research and developing and sustaining large initiatives; for infrastructure and process, we focused on reimagining core facilities and space utilization and sharing.

While the Task Force did not consider baseline or outcome metrics, the Office of Research and Innovation captures data relevant to most of the proposals, including sponsored program dollars, number of proposals, number of awards, number of partnerships established, number of faculty using research enablement services, and use rates for core facilities. In addition, the university captures data on faculty, staff, and student retention. Beyond these metrics, the proposals outlined in this report should also be evaluated more holistically through the lens of faculty, staff, and student success.

The resources needed and obstacles anticipated fell into common categories across the proposals. These included the need for seed funding to catalyze efforts; the development of research infrastructure and mechanisms; changes to culture, expectations, values, and incentives; flexible, adaptable, and available space; and the development and documentation of best practices. Within each proposal, we identify which strategies can be implemented in the short term and which strategies will require more long-term focus, working with the Office of Research and Innovation and the research advisory committees.

TASK FORCE MEMBERSHIP

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PROPOSAL 1: IMPROVE RECRUITMENT AND RETENTION FOR RESEARCH ADMINISTRATORS, RESEARCH STAFF, AND GRADUATE STUDENTS

THEME: PEOPLE

Research teams and administration involve many people with different, specific skill sets, backgrounds, and levels of experience. To solve challenging world problems, we need a talented and diverse research community. However, NC State does not offer career-banded job classifications in research administration — as are available in virtually all other support staff activities, including but not limited to, general administrative support, accounting, information technology, and human resources. In addition, non-faculty research staff are often hired into positions with limited assurances of future funding — and without a clear understanding of potential opportunities for growth in their career. Research administrators and staff at NC State lack a defined career path — which could not only promote their professional growth but also facilitate their retention. As a result, we routinely lose qualified staff to other institutions and are constantly recruiting and training new research staff. The constant training of new hires consumes time and resources, while the lack of historical knowledge and expertise can delay the timely processing of research-related actions — and lead to costly errors.

NC State's minimum salary for graduate students is North Carolina's minimum wage, and the salaries

vary due to the wide range of programs offered and each program's access to state and external funding. In addition, student fees are significant, and can not be covered through external funding or state funds. This can make it difficult to recruit top national scholars and also impacts research continuity.

Alignment to Strategic Plan. Goal 2 ("Research and Scholarship") of the university strategic plan emphasizes our commitment to developing the critical institutional resources needed to support NC State research and scholars. Goal 4 ("Belonging") emphasizes the creation of a sense of belonging, which goes beyond diversity and inclusion to make sure people feel valued and respected at all levels in our university community.

Strategies

> Develop a research administration career path. #RAcareer

> Review, define, and create recommendations around the available career paths, and bridge funding options for all non-faculty research staff. #ResearchPath

> Include all – or part of – student fees in the cost of tuition to increase potential recruiting and retention of graduate students. #GradSalary

Discussion. Talent and expertise are essential to the research enterprise. To create a research environment with diversity of expertise and thought, we need a culture and processes that are equitable — and allow all people to feel valued and included. We want to be able to both attract diverse talent externally and also better allow for professional growth within our institution. Retention strategies can reduce turnover as well as the associated expenses of hiring and training new employees. Critical factors in employee retention include employee satisfaction, opportunities for professional development, and paths to advancement. The 2019-2020 Pursuing Operational Excellence Task Force report recommends that NC State enable more upward mobility within the university.

Research administrator positions play a key role in the infrastructure of an R1 university. Internationally, research administration is recognized as a career path, and many universities now offer master's degrees in research administration. At NC State, however, there is not a job title, career path, or career band for research administration. This results in high turnover, inconsistent job descriptions and compensation across units, no path for advancement, and difficulty recruiting qualified candidates. When recruiting for research administration positions, there is often a mismatch between what is being advertised in terms of the job title (e.g., accountant, program specialist) and the actual duties required to effectively manage sponsored research programs. The recruitment process for these positions can be lengthy and unsuccessful due to the misalignments in job expectations and salary. Retention is also a challenge due to the number of universities regionally. Between pandemic-related changes in job-market trends and Raleigh's rapid growth, external recruitment has increased significantly. When research support positions are unfilled, the burdensome administrative duties fall on faculty or other staff members who are only tangentially involved in the research enterprise. Developing a career path for research administrators could potentially increase retention, improve recruitment success and candidate quality, increase employee satisfaction, stabilize research support infrastructure, improve research compliance, and provide better service to faculty.

Professional-track research staff are essential members of research teams. While there are job titles for research practitioners and program managers[1] and non-tenure-track faculty positions, there is still a lack of clarity about what the potential career paths are for non-faculty research staff. These positions are often funded by sources outside the university for limited amounts of time and with limited certainty. NC State has many centers, institutes, and large initiatives that are supported by professional-track research staff.

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[1] *https://ehra.hr.ncsu.edu/wp-content/uploads/sites/8/2016/01/epaResearchDef.pdf*

Reviewing, and potentially revising, the guidance for professional-track research staff and developing bridge funding options could improve mobility options within the institution for these experts.

There have been multiple discussions about developing guidance for graduate student salaries at NC State and addressing the issue of how to ensure a clear, sustainable funding model that provides a living wage for a guaranteed period of time. Progress has been hindered by the complexity of the issue. If the university moved toward the inclusion of all (or part of) the student fees being integrated into tuition, these fees could then be covered either directly through the Graduate Student Support Plan (GSSP) or through external funding, which would result in an effective "pay raise" for the students of close to $3,000/yr ($2,607.60 for the 2021-22 academic year for full-time students). This change would not solve all of our challenges with graduate student salaries, but it would move the university towards a more competitive salary.

Near-term initiatives: #RAcareer

Longer-term initiatives: #ResearchPath, #GradSalary

PROPOSAL 2: CREATE COLLABORATIVE COMMUNITIES THAT ENGAGE WITH LOCAL, NATIONAL, AND INTERNATIONAL RESEARCH

THEME: PEOPLE

Students, postdocs, faculty, and research staff have largely lost a year in which to connect with local, national, and international research communities and collaborators. And the opportunity to create new contacts, especially, has been severely hampered. The effect of these delays are unclear, particularly in terms of 1) graduate student network development to assist with job placement following graduation, 2) research network development for pre-tenure faculty, and 3) new sponsored program development. Beyond the visible impacts of the pandemic, the development of communities and collaborations is important for student and faculty recruitment and retention, career progression, and the university's overall reputation.

Alignment to Strategic Plan. Goal 3 ("Engagement") of the university strategic plan stresses that NC State must intensify our commitment and capability to engage with community needs. Goal 6 ("Partnerships") emphasizes internal and external partnerships, including a focus on collaboration and engagement with industry and the community; flexible visits by research scholars; and connections among students, faculty, and staff. Goal 7 ("Reputation") suggests that the university should enhance efforts to build strong and strategic global university partnerships.

Strategies.

> Develop a university-wide visiting scholars program to bring diverse voices and prominent scholars to campus. #DiverseVoices

> Expand infrastructure for visiting scholars, to include a streamlined process for initiating visits, space to host visiting scholars, and competitive funding to support visiting scholars. #EasyVisits

> Provide operational and logistical support for organizing and hosting workshops and conferences on campus, particularly those that will have international participants. #EasyWorkshops

> Create a university-wide program to support travel to international conferences and collaboration opportunities. #IntlTravel

> Broaden engagement with local communities. #EngageLocal

> Expand networking events to catalyze connections among faculty. #ConnectFaculty

Discussion. The goal of these proposals is to build and sustain long-term research relationships. Relationships can be built by having external visitors come to campus, by having NC State faculty, staff, and students reach out, or by strengthening internal university connections.

Two strategies for bringing potential collaborators to campus are 1) to strengthen and streamline visiting scholars programs and 2) to provide support for hosting workshops and conferences on campus. We encourage the development of a university-wide program to bring high-profile, diverse scholars to campus for visits. While these visits would almost certainly include a talk, there would be added value in having the scholars stay at the university for up to several weeks. We also suggest focusing on streamlining the process for individual faculty and departments to invite visitors, starting by developing a detailed collection of policies and procedures as well as identifying a dedicated workspace (e.g., one mimicking the Hunt and Hill Libraries Faculty Collaboration Spaces).

While a university-wide visiting scholars program would likely focus on senior scholars, there are additional opportunities to bring diverse voices to campus and strengthen talent pipelines. One approach is to increase awareness — and in turn, the usage — of funding programs that support underrepresented groups' involvement in research[2]. Another opportunity is to develop a pathway to hire participants of the Building Future Faculty program,[3] perhaps via a postdoctoral-fellow-to-assistant-professor program.

In addition to bringing visitors to campus, it is important to support NC State faculty, staff, and students as they travel in order to help them develop research relationships. We suggest expanding programs that provide travel support and seed funding, particularly to develop international collaborations. In addition, encouraging faculty to participate in scholarly reassignment and students to participate in off-campus research experiences will broaden their collaborations and connections.

We also encourage working within North Carolina to expand the translation of research results to local communities. This could include reviewing and potentially reconsidering current policies, costs, and procedures to make NC State spaces more available and easier for local organizations to use. It could also put focus on broadening the community who uses our research resources; for example, by connecting local researchers to NC State core facilities and allowing more people to take advantage of their world-class services and technology. In addition, we encourage the review and expansion of Wolfware Outreach for offering online, non-credit, fee-based training.

To catalyze more connections among researchers within our institution, we encourage the expansion of internal, topic-centered, lightning-talk workshops. When coupled with follow-up receptions, these offer the opportunity to promote interaction and develop new collaborations.

Near-term initiatives: #ConnectFaculty

Longer-term initiatives: #DiverseVoices, #EasyVisits, #EasyWorkshops, #IntlTravel, #EngageLocal

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[2] *https://sciences.ncsu.edu/intranet/funding-opportunities-for-underrepresented-minorities-in-stem/*
[3] *https://diversity.ncsu.edu/building-future-faculty-program/*

PROPOSAL 3: PREPARE, LAUNCH, AND SUSTAIN LARGE RESEARCH INITIATIVES

Large research initiatives support the university's mission of solving the world's pressing problems while also providing our students valuable, hands-on education and research training. Collaborative research teams often respond to calls for large-scale research proposals (RFPs) when they are announced — by which point it's often too late to develop the most-competitive research proposals; with more time to develop the ideas and preliminary data, these proposals could be more competitive. And when proposals are successful, the university faces additional challenges once initiatives, consortia, centers, and institutes have been funded — as we must build the resources and infrastructure to manage and conduct the research and scholarship of these initiatives. What's more, after the initial funding ends, the research area often becomes unsustainable, which results in a loss of expertise in that area and can negatively impact the university's reputation as a whole.

Alignment to Strategic Plan. Goal 2 ("Research and Scholarship") of the university strategic plan focuses on NC State's mission and its commitment to research, scholarship, innovation, and collaboration that ultimately yields solutions to grand challenges. Goal 3 ("Engagement") emphasizes our service mission to provide tangible impacts for our community, North Carolina, and the world. Goal 6 ("Partnerships") describes NC State's belief that problems are solved through innovative partnerships and entrepreneurial thinking.

Strategies

> Expand the identification of upcoming funding opportunities and creation of teams ready to respond. #IdUpcoming

> Train a cadre of faculty and staff leaders in team science to lead to large initiatives. #TeamScience

> Establish a launch team for large new initiatives that is knowledgeable of all aspects of initiative management (e.g., sponsored programs, project management, financial management, hiring, space). #LaunchTeam

> Define best-practice models/mechanisms for the sustainment of centers, institutes, and academies (large initiatives). #Sustainment

> Provide shared tools, administration, and services for large initiatives in the areas of training, team development, proposal preparation, pre-award, post-award management, and sustainability (e.g., centralized services for initiatives for post-award management and development of sustainability plans). #InitiativeTools

Discussion. As part of the university's strategic planning process, the Pursuing Operational Excellence Task Force report noted one of its most important strategies was to identify shared goals that promote the efficient use of resources. Another key strategy from the report was the sharing of best practices in multiple realms of the university's mission. Both of these strategies are core to all the strategies in this proposal. The strategies proposed here are intended to improve efficiency and the use of university resources through sharing of information, services, and best practices.

To prepare, develop, submit, and hopefully win large initiatives, faculty teams and universities need to anticipate the next big areas for funding and be ready to respond when the calls come out. Addressing the world's grand challenges requires excellent people with a diversity of thought and expertise. The university provides a strong Proposal Development Unit (PDU) — focused on innovation and interdisciplinary work

— to serve as a hub for new, large initiatives that position the university in a proactive, forward-looking manner. The PDU and various colleges are establishing "speed dating" events between multiple colleges to form research teams. To continue to grow the university's research enterprise, our resources used to identify upcoming funding opportunities and prepare advance teams should be expanded further.

Once research teams have been formed, they need a wide variety of resources. These teams could be better supported in the long term by having a platform from which they can advocate, promote, coordinate, etc. One solution is to develop and deliver training in "team science," which prepares faculty and staff to lead interdisciplinary programs. Graduate students would also benefit from team science training, so the university should consider ways to engage them as well.

Once initiatives are awarded funding, it's challenging to immediately ramp up the operations of large centers — which often includes everything from creating and hiring new staff positions to procuring major equipment to building websites and creating marketing, promotional, and graduate-recruitment materials. The establishment of a launch team would identify immediate priorities for the initiative and spearhead their implementation for their units for a limited period of time. Hiring the right talent is critical, and the launch team could help build a more diverse research population through active recruitment of students and the development of talent pipelines. This team could also lead the final selection of specific space for large-initiative operations, especially when discussions transcend individual colleges. Establishing a launch team includes a number of key advantages — increased efficiency, the development of university best practices and know-how for launching large initiatives and reduced administrative burden on faculty.

One of the university's biggest challenges is how to sustain large-initiative activity beyond initial external funding. It is common to see capability rapidly degrade following the conclusion of an initial award. When a new large initiative — multi-disciplinary, multi-PI — is funded for five or more years, with a multimillion-dollar budget, the group faces a precipitous loss of resources at the end of the initial external funding cycle. Large initiatives like this should begin sustainment planning early in the funding cycle. The university should support efforts to enhance initiatives' ability to attract industry partners or additional sponsored funding to generate a sustainable path beyond the initial funding.

Large initiatives would also benefit from an increase in shared tools, administration, and services similar to those offered by the Proposal Development Unit and a would-be launch team but that go beyond the point of award — across the entire research life cycle. For example, centralized services for post-award management and the development of sustainability plans. A post-award management team would be responsible for management of the research awards for the initiative and work across all administrative organizational unit codes (OUCs). The university should consider providing services to help large initiatives conduct strategic planning and sustainability planning. Some of the benefits of providing shared tools and resources include increased efficiency, compliance, and improved implementation of large initiatives.

Near-term initiatives: #IdUpcoming, #TeamScience

Longer-term initiatives: #LaunchTeam, #Sustainment, #InitiativeTools

PROPOSAL 4: FACILITATE INTERDISCIPLINARY RESEARCH THROUGH UNIVERSITY STRUCTURES, PROCESSES, AND SPACES

THEME: INNOVATION

Interdisciplinary collaboration is key to the future of research and scholarship. At NC State, we have made tremendous progress toward facilitating interdisciplinary research and scholarship, through programs like the Chancellor's Faculty Excellence Program ("cluster hiring") and the Game-Changing Research Incentive Program (GRIP). However, there are still many unsolved issues around space, resources, processes, policies, and infrastructure to support interdisciplinary research.

Alignment to Strategic Plan. Goal 2 ("Research and Scholarship") of the university strategic plan suggests consideration of ways to use facilities and administrative funds to support interdisciplinary and interunit collaboration. Research funders are increasingly supporting interdisciplinary investigations into complex scientific and societal problems — which requires a re-examination of university infrastructure. Goal 6 ("Partnerships") highlights that NC State is already home to more than 70 world-class centers and institutes, with more than 1,000 NC State faculty who are members, nearly all of whom work on interdisciplinary projects.

Strategies

> Train a cadre of Interdisciplinary Faculty Fellows. #iFellows

> Develop a "Faculty Success Center" as a hub for faculty resources, such as manuscript/grant editing, shared workspaces for interdisciplinary teams, and workshop space for professional development seminars to increase faculty success in securing external funding. #FacultySuccess

> Examine university processes for how centers, institutes, and academies (large interdisciplinary initiatives) are funded. #IDFunding

> Examine how teaching credit is provided for cross-department or institute/ academy-based courses. #IDTeaching

> Examine models for large-scale interdisciplinary programs. #IDPrograms

Discussion. In 2016, the National Science Foundation identified convergence research[4] as one of the 10 Big Ideas for Future NSF Investments. From the NSF definition, convergence research "entails integrating knowledge, methods, and expertise from different disciplines and forming novel frameworks to catalyze scientific discovery and innovation."

Spearheading and conducting interdisciplinary research is hard. We need qualified and capable leaders who can step up to such opportunities — and commit the time and energy required to nucleate and grow these types of research initiatives. Another option, inspired by the University Faculty Scholars program, could be to create an Interdisciplinary Faculty Fellow award. The award could include access to some limited financial resources, but naming these individuals would also identify them as leaders for growing interdisciplinary research at NC State. Both "University Faculty Scholar" and "member of the Research Leadership Academy" are well-recognized concepts at NC State, and there is a common vision of the expectations and roles of those individuals. The same kind of recognition would be valuable for leaders in interdisciplinary research.

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[4] *https://www.nsf.gov/od/oia/convergence/index.jsp*

To better support faculty who conduct interdisciplinary research, the university could consider a Faculty Success Center (FSC). Similar to the NC State Academic Success Center, the goal of the FSC would be to facilitate successful outcomes among tenure-track and professional-track faculty members in the realms of research, scholarship, and engagement. The center would provide a comprehensive array of support services in a central location, accessible to faculty from each college. These services could include writing consultation and professional editing; targeted individual mentorship/consultations (e.g., caregiving on the tenure track, becoming a public scholar, ethical and sustainable community engagement); faculty affinity groups (e.g., assistant professor group, academic parent group, first-generation professor group); methods consultation (e.g., an NC TraCS satellite office); interactive workshops/seminars featuring collaborative research teams within the university and beyond.

Each new interdisciplinary initiative pieces together startup funding from grants; contracts; facilities and administrative (F&A) cost return; gifts and development, enrollment funding; and funding from departments, colleges, and offices (e.g., the Office of Research and Innovation and the Provost's Office). The expectation is that the initiative has a small number of years to become self-sustaining — but this is not possible for all initiatives and their staff. The university should consider how strategic initiatives can establish models for sustainment that alleviate the annual uncertainty of requests to multiple university offices and organizations.

Graduate programs are both significant contributors to NC State's research enterprise and benefactors of it. Nurturing the fundamental link between research and academic programs requires focus and flexibility. In that respect, the way NC State administers its inter/multidisciplinary academic programs is concerning in several respects:

> Due to their "distributed" administrative structures, these programs typically do not have real advocates outside of the programs themselves (e.g., among the departmental and college leadership, at the university level, or both).

> The budgets for such programs might rely on contributions from several sources, with various degrees of commitment; in short, Directors of Graduate Programs may have to knock on a lot of doors every year.

> Enrollment funding follows courses rather than instructor/faculty; this is a disincentive for departments to "allow" their faculty to teach in interdisciplinary programs or to work toward the development of such programs.

> The average time it takes to get a new academic program approved at the UNC System level is prohibitively long (up to several years). This discourages innovation.

These challenges do not only affect academics at NC State; they have a significant impact on research as well. Indeed, an energetic and innovative academic program related to an interdisciplinary field of research can and should naturally function as a hub of activities in that field for faculty and researchers; the increased visibility resulting from offering academic programs in critical areas also benefits the corresponding research groups and NC State at large. These issues require focus and attention, potentially following models adopted by institutions such as the University of Arizona, the University of Washington, and particularly the University of California Davis[5], where a flexible, faculty-driven approach is used to manage interdisciplinary programs.

Near-term initiatives: #iFellows

Longer-term initiatives: #FacultySuccess, #IDFunding, #IDTeaching, #IDPrograms

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[5] *https://grad.ucdavis.edu/programs/graduate-groups*

PROPOSAL 5: REIMAGINE RESEARCH CORE FACILITIES AND SERVICES

NC State researchers have a variety of research enablement needs that extend beyond core equipment and hardware facilities, which would make them more competitive in attracting sponsored funding.

Alignment to Strategic Plan. Goal 2 ("Research and Scholarship") of the university strategic plan highlights the importance of continued investment in infrastructure and procedures that support NC State's research and scholars to maintain our place as a preeminent research institution. Goal 5 ("Transformative") focuses on pursuing cutting-edge technologies to empower and make our campus more effective.

Strategies

> Expand the concept of core facilities beyond lab-based equipment to include core research services to better meet future research and scholarship needs across the university. #CoreServices

> Define a process to strategically identify new cores and services to meet current and future research and scholarship needs. #NewCores

> Review peer institutions' funding models and develop flexible funding models for the establishment of cores that lead to sustainability. #FundingCores

> Develop standard operating procedures and best practices for the development of new core facilities and services. #CoreSOPs

Discussion. Research core facilities provide central access to cutting-edge equipment and resources. They are typically fee-based service centers used by both internal and external stakeholders. This strategy saves the university money and provides hands-on education to students and broader access to faculty and staff while also helping the university maintain state-of-the-art facilities. Continued investment in core facilities and equipment is needed; however, the concept of core facilities should be broadened beyond lab-based equipment to include research enablement services to better address research and scholarship needs across the university. Some examples of potential service cores are analytics consulting, graphic and product design services, a faculty success center, research project management, and design-thinking expertise.

The university should prospectively value what kinds of cores might be needed for the future. Historically, some cores have developed from individual faculty needs. In addition to evaluating individual faculty needs, we need to look at national and international trends and opportunities for strategic growth, as well as our external partners for input. As the university considers new cores, it should develop a process for strategically identifying which cores should be established and where. Similar to the faculty cluster process, this could be driven by ideas faculty submit for review and selection.

Core facilities and services are often in shared research spaces, and the strategies outlined below in Proposal 6, Reimagine Research Space, apply here, too. There are some unique questions and challenges to consider when establishing new core facilities and services. How will the initial start of the core be funded? Will the core be self-sustaining? To be considered a core facility and service, does it have to be centralized, or should cores be considered at multiple university levels (i.e., departments, colleges, offices)? These issues can be addressed by developing funding models for the establishment of cores that lead to sustainability and through the development of standard operating procedures and best practices for the establishment of new cores.

Near-term initiatives: #CoreServices, #NewCores

Longer-term initiatives: #FundingCores, #CoreSOPs

PROPOSAL 6: REIMAGINE RESEARCH SPACE

THEME: INFRASTRUCTURE/PROCESS

Most universities face a shortage of space as research expands beyond a single discipline. Spaces where faculty and students share common tools have grown substantially, in the form of core facilities. However, while laboratory-based researchers and students often share equipment and laboratory space, there aren't guidelines or best practices to follow when setting up shared spaces, particularly as it relates to environmental, health, and safety considerations, repair costs, etc. In addition, during the pandemic, we have realized how much research work can be done virtually — particularly analytical and computational work. The question is how to reimagine the use of research space moving forward.

Alignment to Strategic Plan. Goal 6 ("Partnerships") of the university strategic plan recognizes that additional space is required both centrally and within each college and other units to facilitate building and strengthening institutional partnerships. In addition, it calls for investment in physical and virtual spaces that enhance research, promote collaboration and engagement with industry and the community; enable flexible visits by research scholars and industry partners; and bring students, faculty, and staff together. The university needs new, multipurpose and flexible spaces that further augment our partnership services and support.

Strategies.

> Document lessons learned about research space utilization from the pandemic and identify what practices should continue. The lessons learned may differ for laboratory, non-laboratory, clinical, community-based, and partner-based research. #SpaceUtilization

> Develop guidelines and best practices for managing shared research spaces, both laboratory and non-laboratory. #ManageSpace

> Pilot innovative models for sharing spaces, staff, and resources for research. #OneStopSharingShop

> Identify and develop tools to help manage shared and virtual spaces. #SpaceTools

Discussion. Informally, the COVID-19 pandemic has demonstrated that many research activities can be conducted remotely, and it has renewed the conversation about the need for and uses of faculty offices.[6] The pandemic has also highlighted the importance of high-speed, ubiquitous wireless access. However, research at NC State takes many forms (e.g., laboratory, clinical, community-based, extension, partner-based), each having its own space requirements. If the university wants to prioritize adaptable, reconfigurable, and flexible space — and ensure that its spaces are inclusive and accessible — moving forward, then capturing detailed lessons learned about space utilization will provide valuable data. The university might also consider expanding the resources available to the University Space Committee, following the model of the University of Colorado Boulder, which established an Office of Space Optimization with a full-time director.

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[6] Does the Faculty Office Have a Future? *Chronicle of Higher Education*, May 6, 2018.

Laboratory space is a finite resource at NC State. To grow our research enterprise, we must better utilize space. And sharing laboratory space has become increasingly common. There are, however, inherent challenges with sharing laboratory space that have not been directly addressed, which limits the willingness of some researchers to consider sharing research space. For example, Environmental Health and Safety (EH&S) asks for one PI to be listed on the laboratory safety plan, with a secondary safety contact. The PI of record is ultimately the PI responsible for the safety of that space, even though students from other PIs' groups are utilizing the space and might have different safety training or expectations. In addition, if informally shared equipment breaks or consumable supplies dwindle, there should be a mechanism to support repairs and consumable purchases. But informal shared space often doesn't qualify for operation as a university service center — meaning there may be limited opportunities for financially sustainable shared spaces. While we cannot address all concerns over informally shared laboratory space, the creation and dissemination of best practices for informal shared laboratory spaces could inspire departments to consider this model as a means to grow their research activities; it could also help guide PIs and departments in establishing sustainable, inclusive, and safe practices that are transparent to all stakeholders.

Conventionally, shared research space focuses more on the tangible and physical components of research and innovation. If managed well, it can foster disciplinary and interdisciplinary collaboration. As the technologies advance and the business/social contexts become more complex, a new paradigm of shared space is needed to create more efficient and meaningful innovation. In addition to facilities, equipment, and their logistics, shared space could be expanded to shared resources that encompass both tangible and intangible elements of research and innovation. A one-stop sharing shop could be established at NC State to integrate the sharing of space, equipment, grant writing, business plan development, data analytics, engineering, design (product, graphic, branding), budget administration, marketing, business development, networking, etc. Based on the findings and lessons learned, and in collaboration with recommendations from the How We Work Task Force, the university should pilot innovative models for sharing space, staff, and resources for research.

In addition, the university could consider a centralized software system to track space usage, including reservations, floor plans, 360-degree camera views, technology capabilities, space-use agreements, and class schedules.

Near-term initiatives: #SpaceUtilization, #OneStopSharingShop

Longer-term initiatives: #ManageSpace, #SpaceTools