

Research Briefing

BACKGROUND

Oregon State University is a top research university, producing scientific discoveries and generating innovations that address grand, global challenges. The university continues to lead in practical, problem solving research, particularly in its three signature areas: the science of sustainable earth ecosystems; health and wellness; and economic prosperity and social progress. With its commitment to increasing diversity in science, technology, engineering and mathematics (STEM) and other fields, the university continues to train the next generation of scientists and scholars. This report summarizes the university's progress in reaching its research goals, describes special initiatives aimed at advancing the research enterprise, and discusses research-related opportunities and threats facing the institution.

RESEARCH AT OSU

Oregon State's research activity takes place in the colleges, schools and departments, as well as centers and institutes. The Research Office (RO) is the central administrative unit tasked to support and enable research. The RO includes three main functional areas: 1) [The Office of Sponsored Research and Award Administration \(OSRAA\)](#); 2) [The Office of Research Integrity \(ORI\)](#); and 3) [The Office for Commercialization and Corporate Development \(OCCD\)](#). In addition, the RO oversees 20 cross-university [centers, institutes, and core facilities](#).

SP4.0 RESEARCH ACTIONS

Oregon State's Strategic Plan (SP4.0) captures the university's research mission most directly in Goal I: Preeminence in research, scholarship, and innovation. The RO provides leadership for multiple actions and tasks in [SP4.0](#). Specifically, the vice president for research (VPR) co-leads, with the dean of the Graduate School, Action 3 to *diversify OSU's research portfolio and strategically build graduate programs*; is lead on Action 6 to *substantially improve OSU's physical and administrative research infrastructure*; and co-leads Action 15 to *strengthen OSU's support system for innovation and entrepreneurship*. The RO leadership team has aligned annual goals with projects under these actions and is currently in the implementation phase.

METRICS

Below is an analysis of these key metrics and associated data that are used to track research performance and economic impact nationally.

Research Performance

Research and Development Awards and Expenditures

OSU recorded \$449.9M in research grants and contracts for FY2020, including almost \$52M from the Department of Energy for the PacWave South energy-testing site off the coast of Newport. The total funding is up from \$439.7M in 2019 (see Figure 1).

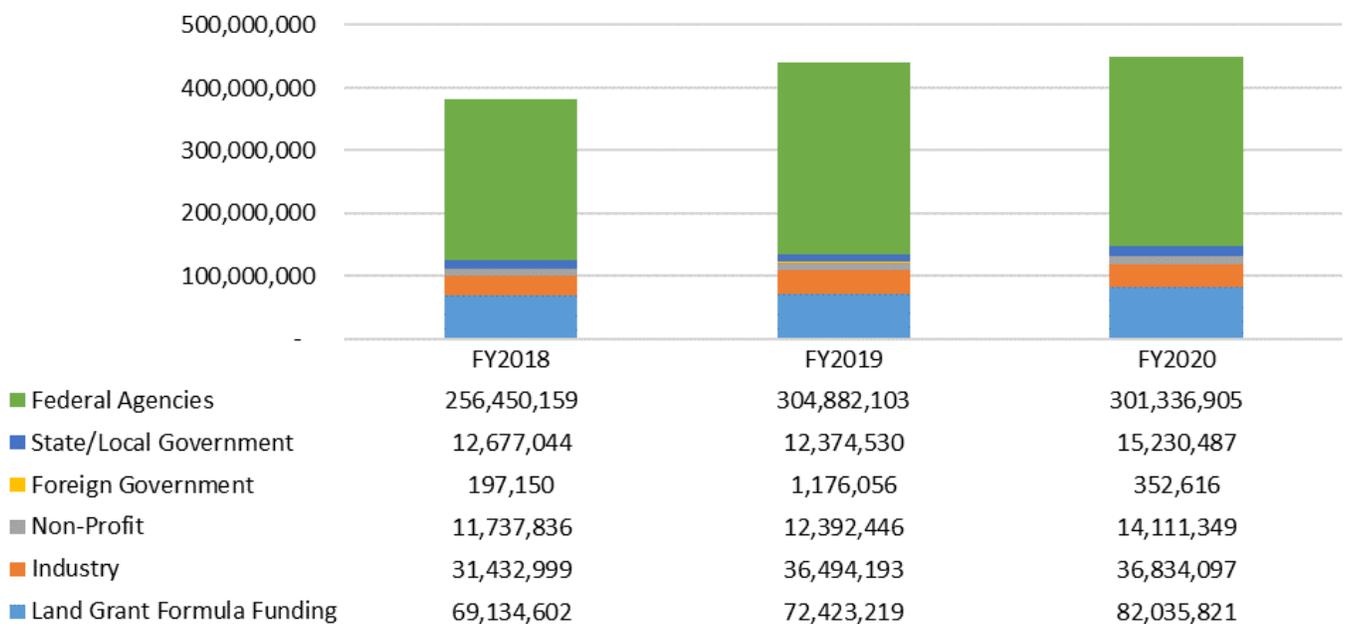
In 2017, OSU posted its highest level of annual funding to that point, \$441M, partly due to receipt of a \$122M grant for construction of a new research vessel. The National Science Foundation provided OSU \$88M in 2018 for a second vessel — when the total research funding for the university was \$381.6M — and \$108M in 2019 for a third ship. There was \$25M in supplemental research vessel funding this year. Removing the research vessel funding out of the equation, this year's total represents an impressive 28% increase in grant-

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funded research over last year, a testament to OSU faculty and researchers' creativity and productivity.

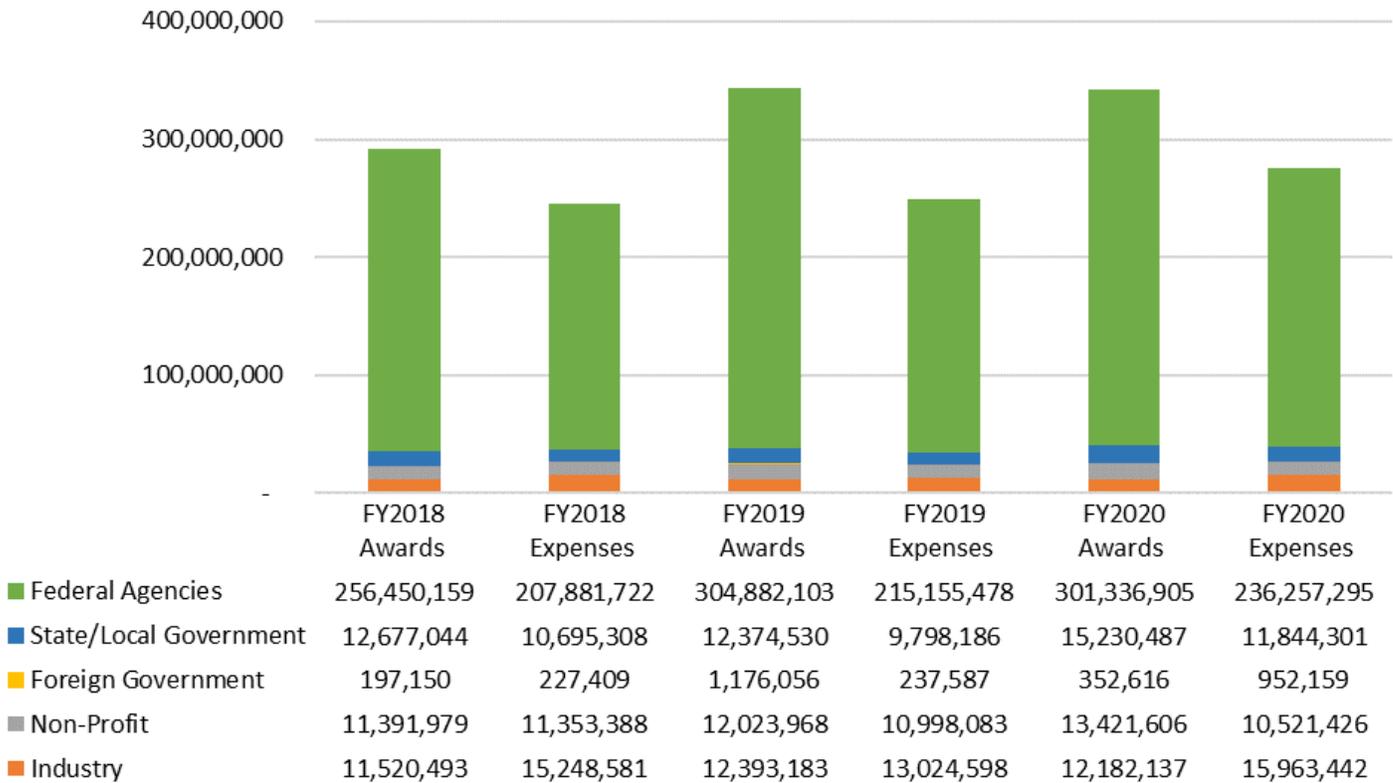
Federal funding of \$301.3M accounts for 67% of OSU's FY2020 research grants and contracts. Notable among these numbers is an 11% increase in funding from the Department of Health and Human Services to almost \$30M as this funding source was an area of focus this year.

Figure 1: FY2018-20 Research and Development Revenue by Sponsor Type. These data capture all financials directly and indirectly related to research, including sponsored project awards as well as foundation gifts, testing, licensing revenues in support of industry research, and federal and state land-grant formula funding. Source: Office of Research Annual Award Data.



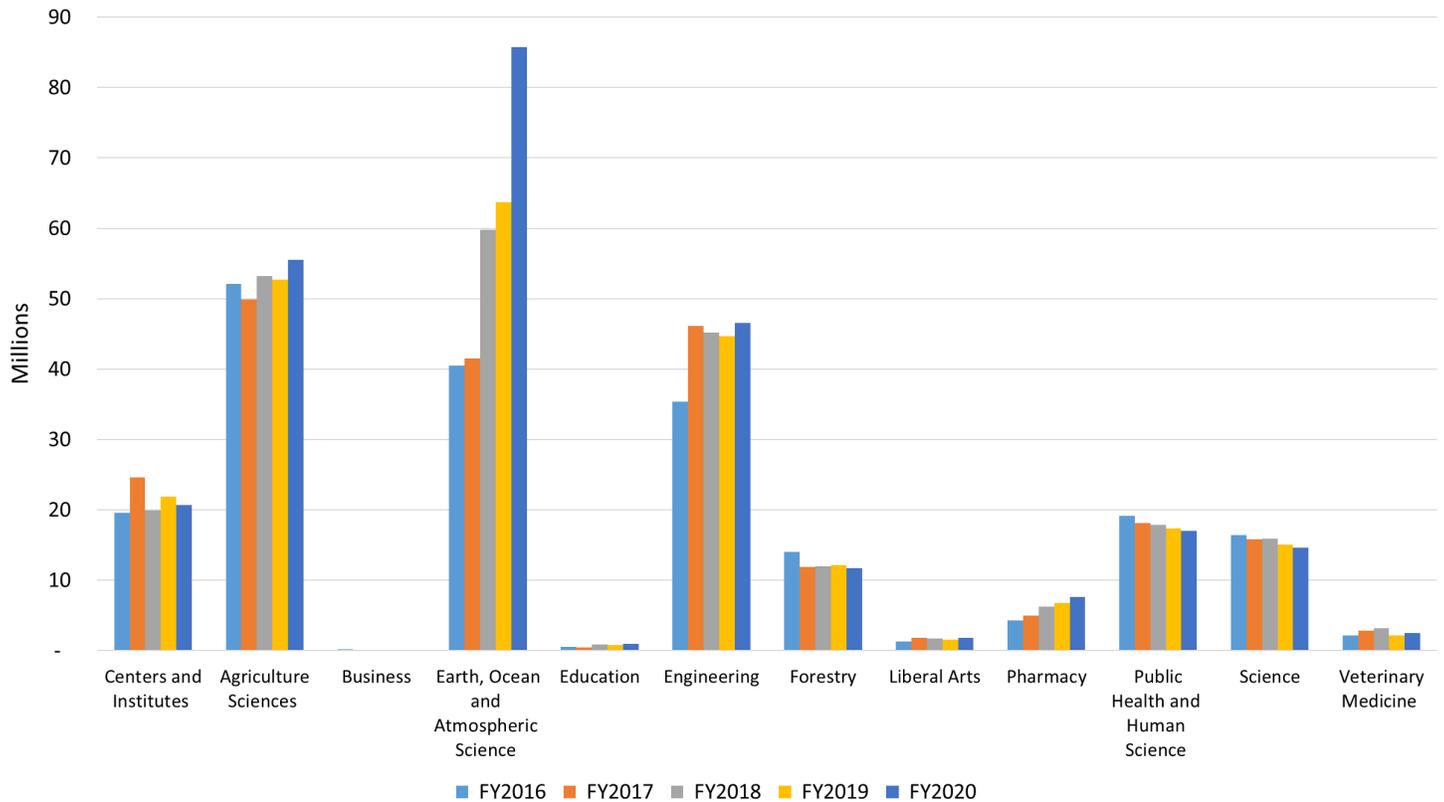
Research expenditures slowed in the second half of FY2020, given the challenges of conducting research during the pandemic, but they still increased by 9% overall compared to FY2019 (see Figure 2). This follows a trend of 3% and 9% increases in the previous two years. Expenditures for the first 5 months of FY2021 are in line with pre-COVID spending trends, suggesting that the research enterprise is adjusting to pandemic-related measures.

Figure 2: FY2018-FY2020 Research Awards and Expenditures by Sponsor Type. All restricted funds administered by the RO (includes Other Sponsored Activities). Does not include Agriculture Research Foundation gifts in support of research, OSU Foundation awards and gifts, testing income (in support of business and industry), and licensing and royalty income.



Expenditures by college or center/institute (see Figure 3) show increases in research expenditures for many of the units and highlight the large expenditures that are starting to take place in relation to the construction of the research vessel (note large increase for College of Earth, Ocean, and Atmospheric Sciences (CEOAS)).

Figure 3: FY2016-20 Total Research Expenditures by College and Centers/Institutes. All restricted funds administered by the RO (includes Other Sponsored Activities). Does not include Agriculture Research Foundation gifts in support of research, OSU Foundation awards and gifts, testing income (in support of business and industry), and licensing and royalty income.



Innovation and Economic Impact

OSU’s engagement with business and industry totaled \$36.8M — the fifth consecutive year that exceeded \$30M. Sources include technology licensing, contracts for testing, support through the Agricultural Research Foundation and research gifts through the OSU Foundation. Almost half of the revenues covered costs for technology testing services conducted by OSU labs to document the performance of innovative products and services. Continued research investments by industry reflect the university’s expanding leadership in fields from nuclear engineering and hemp, to robotics and wood innovation.

Of specific note, during the pandemic, there has been growth in innovation activity (see the 25% increase in inventions shown in Table 1) and some successful start-up developments, including Outset Medical going public, Agility Robotics raising a series B \$20M investment, and NuScale receiving a final design certification from the Nuclear Regulatory Commission. Participation in innovation commercialization programs has also increased:

- 35% increase in faculty participation in Innovation Days (held virtually). The “Innovation Days” are held each term to help faculty and student researchers learn more about OSU’s innovation support programs.
- 40%+ growth in interest and participation in University Venture Development Fund Aid applications from a broad selection of colleges. This fund is directly connected to OSU Advantage Accelerator programming and supports faculty in customer discovery, customer validation, commercial feasibility studies, minimal prototype development costs, market research, and/or commercialization plan development.

Invention Disclosures

Inventions disclosed increased by 25% — this increase was primarily driven by two areas: an intentional effort made by the RO to increase software-related innovation and the pandemic driving more interest in life science-related innovation.

Licensing Revenues

Revenues from companies commercializing OSU intellectual property remains relatively flat for the third year in a row, as previously forecasted. Agricultural varieties make up approximately 51% of all licensing revenues at OSU, similar to other land grant universities with large colleges of agricultural sciences. OSU has seen a decrease in other areas (-30%) toward the end of the fiscal year as companies seem to be pausing or delaying until the economy stabilizes.

Industry Research

Industry sponsored research began stronger than FY2019 in the first half of the fiscal year, but the pandemic led to sharp decreases in awards in the later half, and total awards fell slightly in FY2020 (Table 1).

Table 1: Invention disclosures; licensing revenue; industry sponsored research

Invention Disclosures	FY2018	FY2019	FY2020
College of Agricultural Sciences	21	24	27
College of Business	0	0	1
College of Earth, Oceanic, and Atmospheric Sciences	1	0	2
College of Education	0	0	0
College of Engineering	37	29	35
College of Forestry	3	2	5
College of Liberal Arts	0	1	0
College of Pharmacy	8	15	10
College of Public Health and Human Sciences	2	0	8
College of Science	11	14	13
College of Veterinary Medicine	3	1	9
University Total	86	86	110
Unduplicated Total	77	80	100
Licensing Revenue	FY2018	FY2019	FY2020
College of Agricultural Sciences	\$ 2,330,306	\$ 2,135,811	\$ 2,128,640
College of Business	\$ -	\$ -	\$ -
College of Earth, Oceanic, and Atmospheric Sciences	\$ 15,933	\$ -	\$ 6,202
College of Engineering	\$ 710,929	\$ 1,881,687	\$ 1,256,894
College of Forestry	\$ 643,016	\$ 67,257	\$ 156,761
College of Liberal Arts	\$ -	\$ -	\$ -
College of Pharmacy	\$ 300,348	\$ 174,796	\$ 260,424
College of Public Health and Human Sciences	\$ 7,534	\$ 7,316	\$ 2,541
College of Science	\$ 157,956	\$ 88,585	\$ 71,754
College of Veterinary Medicine	\$ 5,000	\$ -	\$ -
Other (Executive Office)	\$ -	\$ 2,647	\$ 252,059
Research Office - Centers & Institutes	\$ 230,166	\$ 35,219	\$ 4,982
University Total	\$ 4,401,187	\$ 4,393,318	\$ 4,140,258
Industry Sponsored Research	FY2018	FY2019	FY2020
College of Agricultural Sciences	\$ 620,473	\$ 1,175,714	\$ 1,404,214
College of Business	\$ -	\$ -	\$ -
College of Earth, Oceanic, and Atmospheric Sciences	\$ -	\$ -	\$ -
College of Education	\$ 20,000	\$ -	\$ -
College of Engineering	\$ 3,209,788	\$ 3,706,261	\$ 3,786,659
College of Forestry	\$ 99,749	\$ 250,000	\$ (163,691)
College of Pharmacy	\$ 16,153	\$ 600,113	\$ -
College of Public Health and Human Sciences	\$ 49,179	\$ 93,489	\$ -
College of Science	\$ 287,489	\$ 10,220	\$ 139,200
College of Veterinary Medicine	\$ 512,852	\$ 142,130	\$ 189,175
College of Liberal Arts	\$ -	\$ -	\$ 75,991
Research Office - Centers & Institutes	\$ 411,502	\$ 200,000	\$ 640,660
University Total	\$ 5,227,185	\$ 6,177,927	\$ 6,072,208

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SPECIAL INITIATIVES & PROJECTS

The university prioritized the following actions in 2020 to strengthen its research mission and assess and manage the pandemic's impact.

Manage COVID-19 Impact on the Research Enterprise

The pandemic impacted OSU's research in a significant way. The research enterprise underwent a rapid shutdown in March 2020 in response to the Governor's executive order as laboratory activities were ceased, field work was cancelled, sea-going work was delayed, and all research-related travel was suspended. All research activities that could not be carried out remotely had to be paused. Some limited research was deemed critical, mostly related to tending to unique specimens and collections; plants and animals or cultures; highly specialized analytical, manufacturing, and computing facilities; and field-based facilities.

OSU planned carefully for research resumption starting in May 2020 with the formation of a Task Force for Research Continuity and Resilience. The task force articulated research resumption values that subsequently guided the prioritization, requirements, timing, and approval process related to research resumption activities.

Research resumption occurred starting in mid-June once the Oregon Governor's Executive Order allowed the resumption of some research activities. Oversight of resumed research was carried out by deans and the VPR, aligned with the overall pandemic response overseen by the Continuity Management Team, and required unprecedented coordination and cooperation among units. Much communication and coordination also occurred across all of Oregon's public and private institutions. In the staging of research activities, the most conservative approach was applied to activities related to human subjects and those involving animals. Seagoing activities also received special attention to assure alignment with fast-evolving industry standards.

As a result of these efforts, OSU's research enterprise experienced a thoughtful, adaptive, and gradual resumption phase over the course of the summer and fall 2020, including both on- and off-site efforts, essential travel, and research cruises. No specific increases in COVID-19 cases occurred over the course of the summer that were tied to research activities.

Diversify OSU's Research Portfolio (SP4.0 Action 3)

The RO has responsibility for setting strategy and identifying mechanisms for diversifying OSU's research portfolio as part of SP4.0 Action 3. Progress was made in two tactical areas in FY2020, both involving research development activities that enable partnerships and spark new ideas to those that support project development. Research development activities also encompass work geared toward influencing federal and state research priorities so that OSU's work can achieve more immediate impact.

Build new collaborations that strengthen signature areas of research (Tactic 3.2)

Strengthening OSU's signature areas of research requires the institution to be intentional about research development. These efforts span a range of activities including idea generation, team formation, identification or creation of funding opportunities, and securing the needed funding to make the ideas come to fruition. At each step of the way, institutions help with providing incentives and seed funding, facilitating constructive criticism to fine tune

ideas and proposals, building bridges to collaborators and agencies, and providing administrative support.

Over this past year, OSU has engaged in a variety of new research development activities spanning this spectrum. For example, “Ignite” research colloquia were organized on various topics to facilitate connections among researchers and spark collaborative ideas. Seed and inception funding served to enable teams to complete preliminary work or collect initial data to form the foundation of a proposal for external funding, and targeted support during the proposal-writing process, including grant-writing support and reviews, served to strengthen the proposal.

In addition, the RO began to provide targeted support to large and complex project proposals, proposals to prestigious programs and foundations, and solicitations that only allow a limited number of proposal submissions per institution. This targeted support includes early and frequent interactions during proposal budget development, individualized support related to subawards to other institutions or for other complex budget issues (such as large purchases or complicated procurement plans), administrative support with proposal submission portals, a review team designed to address the needs of the specific proposal, and prioritized attention near the proposal deadline to resolve last-minute problems.

These collective efforts by the colleges and the RO have so far led to the formation of numerous new teams and proposals. In 2020, OSU submitted six large projects to various agencies including the National Science Foundation (NSF) and National Institutes of Health (NIH). Nine more such projects are slated for 2021 in the \$3M-\$20M range and primarily to NSF and the National Oceanic and Atmospheric Administration (NOAA). Collaborative and deliberate efforts along these lines helped OSU win a prestigious award from the Keck Foundation and multiple Murdock Foundation equipment grants, supported the rapid spin-up of TRACE-COVID, and helped OSU to pass through multiple gates to potentially receive funding for a highly competitive and very prestigious NSF Science and Technology Center. These successes point to the effectiveness of research development activities.

Begin increasing strategic partnerships with federal agencies (Tactic 3.3)

During the pandemic, federal funding agencies have been great supporters of university research, providing spending flexibility where possible and setting up new solicitations for funding opportunities in research topics related to the pandemic. In 2021, new funding opportunities are expected, ranging from health sciences to climate science. Positioning OSU to be successful in securing these new funding opportunities requires the research development efforts described above, as well as developing agency-specific strategies to ensure success.

Over the past year, OSU set up two strategy working groups. The first working group is targeted toward increasing funding from the NIH, with the charge to identify areas where OSU can build on existing success (e.g., infectious diseases), as well as to identify new areas of research aligned with areas of interest to NIH during and post-pandemic (e.g., health disparities). The second working group is focused on increasing funding from NOAA, with the charge of reaffirming OSU’s international reputation in ocean and climate related research by identifying competitive advantage and becoming a trusted partner for NOAA.

Strengthen Support System for Innovation & Entrepreneurship (SP4.0 Action 15)

To advance OSU's goal to strengthen the support system for innovation and entrepreneurship, one tactic made substantial progress, with two other tactics currently being worked on.

Implement promotion & tenure guideline changes & incentive structures (Tactic 15.2)

OSU received an NSF grant and held a virtual summit in September 2020, allowing the university to lead a national conversation on incentivizing and rewarding faculty's efforts in innovation and entrepreneurship. Through significant outreach, OSU is now joined by over 65 leading universities across the US as coalition members and 11 national, non-profit stakeholders in support of this effort. A set of recommendations were developed and unanimously adopted at the summit. Additional conversations with coalition members on implementation will continue this year.

In parallel, OSU charged a promotion and tenure (P&T) committee to look at innovation and entrepreneurship holistically. The committee unanimously recommended adoption of the national recommendations. Additional conversations with stakeholders across OSU, including the Faculty Senate, will begin this year.

This initiative is:

- Incentivizing OSU faculty to engage with industry in more and unique ways, driving to expand impact.
- Providing OSU additional branding to attract faculty interested in innovation and entrepreneurship as well as students who are interested in starting a business someday (approximately 72% of Generation Z students indicate interest in starting a business).
- Leading to additional studies that keep OSU at the forefront of tracking the impact of P&T guideline changes and other incentives over the long run.

Improve the Physical and Administrative Research Infrastructure (SP4.0 Action 6)

A key element of ensuring the success of the research enterprise is providing a sound physical and administrative research infrastructure.

Renovate and renew research laboratories and facilities (Tactic 6.1)

The Facilities Renewal Program, and associated execution of the projects on the Ten-Year Capital Forecast, is critical to strengthening OSU's research infrastructure. In partnership with the academic colleges and the Division of Finance and Administration (DFA), the RO has been assessing the condition of the research facilities and equipment housed in them to better understand maintenance and upkeep needs and costs.

Given the need to enhance and care for the research infrastructure, the university is working to align equipment purchases and facility improvements while providing more flexibility for supporting researchers and decreasing administrative burden. Examples of projects underway this year include improvements to animal facilities, renovation of Autzen House (home of the Center for the Humanities), and deferred maintenance projects at Hatfield Marine Science Center (HMSC).

Other examples this year of capital projects approved to support research needs include the seawater system replacement at HMSC, which provides a core capability for the entire facility, including federal and state agencies; the dock replacement for ship operations at HMSC, which will serve as the home of the incoming Regional Class Research Vessel as

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well as the other vessels in Newport; and the replacement of greenhouses on the Corvallis campus.

Retool systems/increase investment in supporting research & innovation (Tactic 6.2)

In addition, the university made significant progress over the past year in efforts to improve its administrative research infrastructure. Below is a list of the major projects.

Implement zero based budgeting for centers and institutes: In FY2019, the RO initiated a review of centers, institutes, and core facilities to assess their impact, efficiency, sustainability, and relevance to SP4.0 goals, working with the colleges and other partners as appropriate. In FY2020, some significant changes were implemented in the Linus Pauling Institute (LPI) and the Cooperative Institute for Marine Resources Studies (CIMRS); and a new strategic plan was developed for the Center for Genome Research and Biocomputing (CGRB). As well, a zero-based budget analysis of the HMSC was conducted to establish its baseline needs as a center supporting research, education, and outreach; the Marine Studies Initiative (MSI); and federal partners. The goal of these efforts is to maximize the value and impact of the centers and institutes as university assets benefitting many.

Develop new business models/plan for core facilities: The RO, DFA, and centers and institutes have convened a workgroup to streamline business functions and clarify roles and responsibilities for research centers and institutes. This working group is in the process of creating solutions that ensure reimagined processes and procedures for OSU's business functions. The goals are to minimize the number of hand-offs; minimize the number of processes to complete a single activity; strengthen internal controls and consider risk; provide adequate backup and cross training; address process and procedure gaps; consider technological options, solutions, and/or barriers; address appropriate resource allocation and constraints; and engage and/or communicate with stakeholders in decisions. At a high level, the intent is to reduce the administrative burden for center and institute directors; add value to the research facilities; increase lab productivity; and provide resources, systems, and tools to assist in with growth.

Invest in retooling of compliance programs: The university is strengthening its research compliance programs to build systems that are effective, efficient, and nimble enough to support the research enterprise. The Human Research Protection Program (HRPP), which administers the Institutional Review Board (IRB), helps to ensure that OSU research involving human participants is performed ethically and in accordance with regulations. The program has faced a variety of challenges and the stresses that have been exacerbated by the pandemic. In response, the RO has increased staffing for HRPP and is taking steps to replace an ineffective electronic protocol submission system, revamping processes, and partnering with the research community to enact sustainable solutions.

The university continued to focus on other key compliance areas, including OSU's Conflict of Interest (COI) and Conflict of Commitment (COC) programs. The university is undertaking a complete review of its COI/COC and related policies with an eye toward adopting a more comprehensive and streamlined approach.

The university has also established a new centralized program to promote research integrity. This program promotes professional standards and compliance with funding agency requirements. Among other things, the program investigates alleged research misconduct, promotes data stewardship, provides authorship and other guidance and

responsible conduct of research training, and, in coordination with the Office of Equal Opportunity & Access, reports instances of Title IX misconduct to funding agencies, as necessary.

Finally, university senior leadership continued to monitor new regulations and executive orders that touch on global aspects of university operations, responding to raised concerns by the federal government about undue foreign influence over institutions of higher education, primarily due to escalating tensions with China. The university continues to help researchers navigate complex export control regulations and other international compliance issues. The university is implementing the best practices to better identify potential conflicts of interest with international partners, vetting of international visiting scholars, reporting of foreign gifts and awards, protecting intellectual property, and more. Importantly, however, while ensuring compliance with federal requirements, the university remains committed to global discovery and partnerships, and seeks to ensure a welcoming environment to collaborators across the globe, as well as our international faculty, staff, and students.

Invest in restructuring sponsored research and awards management programs: Even as OSU's research enterprise and portfolio has been growing and diversifying, the federal funding landscape has been shifting toward funding large, complex, interdisciplinary programs. The combination of these two drivers has resulted in an acute need to restructure OSU's research support infrastructure including research administration and financial compliance functions. A first step in this restructuring has been the major reorganization of the Office of Sponsored Research and Award Administration (OSRAA). Various external reviews pointed toward the needed changes, and an internal process was followed to co-create a new organizational structure. The reorganization effort was initiated in December 2019, with the reorganized structure implemented in October 2020. There are still multiple open positions to fill, so the organization is not yet operating at full scale and efficiency, yet service to principal investigators has already begun to improve.

Develop plan and launch process to optimize revenue agreements and processes: The university is working to improve testing, services, and non-tuition instruction engagement with industry. Support capabilities and resources have been unable to keep pace as OSU rapidly grew its research base, equipment, and programs over the past ten years. A working group identified a number of areas of improvement that, if implemented, could serve as a model to create process clarity and efficiencies that ultimately provide greater support for faculty, contain risk exposure, and add revenues that offset real costs of providing research and services to external partners. The working group is gathering stakeholder input and preparing to provide senior leadership recommendations, as well as an implementation plan that offers the potential to launch in FY2022.

Contribute to attracting and retaining a diverse research workforce (SP4.0 Action 1)

OSU is committed to inclusive excellence, including diversifying the research workforce and enabling the success of all researchers. One area of focus has been to identify and address barriers to accessing resources by researchers from underrepresented backgrounds. This includes creating highly transparent procedures and rubrics for funding opportunities. A related effort has involved beginning an education program for the administrative staff and staff in centers and institutes on issues related to diversity and inclusivity. The university is seeking to attract researchers from diverse backgrounds to OSU by contributing to startup costs using funds dedicated to support equipment purchases and devising action plans in the RO that are in alignment with the university's diversity strategic plan.

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OPPORTUNITIES AND THREATS

A report by Ithaca (<https://sr.ithaka.org/publications/the-senior-research-officer/>) points out a number of major challenges for universities' research enterprise: research offices have had to grow substantially; research revenue and competitiveness have become vital strategic priorities; research support is increasingly seen as a major competitive edge and is often a management challenge; and growing tensions with China have produced a spike in compliance work and concerns about talent flows. The following sections reflect on the opportunities and threats in this context, including efforts to capitalize on opportunities and counter the threats.

Positioning OSU to Diversify Research and Scholarship

OSU is well positioned to secure increased funding in strategic areas related to new opportunities, with world-class faculty and researchers whose research is well-aligned with national priorities.

The pandemic offers an opportunity to potentially diversify OSU's research portfolio further, with several agencies having received funding specifically targeting infectious diseases and pandemic related research. OSU's researchers have been exploring a range of work related to the pandemic, such as tracking and understanding its impacts on health systems and on communities, including disproportionate impacts on under-served communities. OSU researchers have secured 14 funding awards, totaling more than \$5M, from a variety of federal and private sources with several more coronavirus research proposals awaiting decision from funding agencies. Of note is OSU's TRACE-COVID-19 door-to-door sampling that has taken community-wide virus testing to several Oregon cities, as well as OSU's wastewater sampling for community surveillance that is now being expanded state-wide. The TRACE team has also received a \$2M grant from the Packard Foundation to create a national TRACE Center that will expand OSU's COVID-19 public health project to other states.

There are other aspects of the pandemic that have also received attention and created opportunity to showcase impactful scholarly work by OSU's faculty and researchers. For example, researchers focused on stress, coping, and close relationships in times of crisis; international, national, and state strategies/policies addressing the pandemic; how stigma, racism, and other forms of discrimination exacerbate epidemics and suffering; socioeconomic barriers to testing and treatment; the history of national and state strategies/policies addressing the Influenza Epidemic of 1918-19 in comparison to the current pandemic; political and public health messaging during the pandemic, including clarity and interpretation issues; challenges of disaster response planning for supply chain disruption in a global crisis; behavioral changes in response to changing information about COVID-19 risks; and concerns related to food safety and food availability.

The transition to a new federal administration is expected to lead to some major shifts in the federal research funding landscape. For example, a reinvigoration of research related to climate science and impacts is likely to take place. As well, there is a renewed focus on innovation and technology both at NSF and NIH, with significant increases expected to both agencies in the re-authorization, and a new director of NSF with a focus on large complex awards such as institutes and major infrastructure. Attracting funding through these new opportunities will also lead to further increase OSU's reputation and relevance for the state, the nation, and the world.

These funding opportunities are likely to be in the form of large collaborative projects or center/institute competitions, requiring targeted research development. Therefore, OSU is

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currently assessing investments needed to ramp up the necessary research development efforts to support researchers. There is also a renewed interest and opportunity to partner with Oregon's other research universities (Oregon Health & Science University, University of Oregon, Portland State University).

Supporting an Innovation and Entrepreneurship System

As described in the initiatives section above, OSU has been leading a national conversation on the inclusion of innovation and entrepreneurship criteria in P&T guidelines. The university is also focused externally on ways to support innovation and entrepreneurship. The university is participating in a ten-year innovation planning effort led by Business Oregon and is also participating with senior staff on a five-year comprehensive economic development strategy committee being led by Greater Portland Inc. Through participation in both efforts, OSU is focusing on educating members on the importance of major research universities to the state's economy and in driving innovation and identifying key programs needing investment to support the state's long-term innovation-based economic growth.

This work is particularly important given the state's history of short term and relatively small investments in innovation-focused programs. As an example, due to the pandemic and other competing priorities, the state decreased funding to OSU's Advanced Technology and Manufacturing Institute (ATAMI) by 15%. ATAMI is an innovation center that provides an environment for industry to lease space and develop new commercial opportunities for research developed at OSU. It also provides an environment for OSU researchers to conduct cutting edge research in areas of value by industry and the government. These funding reductions could jeopardize OSU's (and the state's) ability to enable innovation and entrepreneurship.

In 2020, the state also cut funding to the University Innovation Research Fund (UIRF) by 74%. The \$10M UIRF was established by the Oregon Legislature in 2019 through HB 2377. Similar to other research universities, OSU often needs to obtain matching funds for federal proposals, especially those aligned with economic development and industry. Without access to such matching funds, OSU will be less competitive for research funding from federal agencies. OSU is assessing additional and more sustainable funding streams to ensure support for innovation and entrepreneurship.

Establishing a Sound Physical and Administrative Research Infrastructure

The success of the research enterprise is critically dependent on ensuring a sound physical and administrative research infrastructure.

Invest in OSU's research laboratories and facilities

Investing in current and new facilities and improving research facilities are key to recruiting and retaining researchers and students that make up OSU's research enterprise. For example, OSU currently lacks an operational biosafety level 3 (BSL3) laboratory, which would permit researchers to pursue funding and conduct research on human and animal pathogens,. This gap limits researchers' ability to be competitive for NIH funding during and after the pandemic. The university is renovating a small, decommissioned BSL3 laboratory on the Corvallis campus, but this facility will not fully meet demand and will likely become obsolete in about 20 years. OSU also has a broad portfolio of animal research that includes mice, rats, zebrafish, snakes, livestock, poultry, and other animals, but its animal facilities are quite decentralized, which introduces challenges related to regulatory oversight, cost, logistics, upkeep, and space variability. Finally, properly supporting and sustaining strategic,

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long-term, multidisciplinary and complex research projects taking place in key research facilities—especially work that requires advanced instrumentation—remains challenging and requires deliberate attention in terms of process, funding and prioritization, and coordinating many different administrative offices (outside of the RO) at the university to ensure the success of large/complex projects.

As one concrete step, the university has established an annual process for capturing future research needs for inclusion within the Ten-Year Capital Forecast. Along with the capital planning project needs, OSU now has an understanding of minor capital projects (<\$5M) that research centers and institutes will request in the next few years. Input on the condition of existing buildings will be sought to help inform the prioritization for Capital Improvements and Renewal funds to upgrade major components of buildings and infrastructure. Having this annual process completed will facilitate identification of the most pressing research infrastructure needs as well as establish funding support to move these projects forward.

To ensure the research enterprise has the capacity to pursue new funding streams, OSU must continue to bolster its IT infrastructure to meet the stringent data security requirements of a growing number of funders. The university is exploring a comprehensive research software solution to maximize the existing equipment usage, facilitate collaboration, improve efficiencies, reduce equipment maintenance expenses, and provide an integrated lab network for the equipment available throughout all centers and institutes.

Re-examine indirect costs to support research & innovation

Facilities and administrative (F&A) costs are an important element of a university's overall costs of research and contribute to its success as a research institution. The rate calculation and negotiation process assures that universities are fairly and equitably reimbursed for their F&A costs incurred under federally funded projects. F&A costs are provided to the university as a reimbursement for real costs incurred in maintaining the physical and administrative infrastructure for research.

The current national F&A rate average for higher education institutions is a full 5 percentage points higher than OSU's current rate. The university is working on ways to ensure OSU's rate components accurately capture all research expenditures within OSU's financial systems, so that the rate fully reflects the costs OSU is incurring to deliver funded research activities. This process will lead to greater transparency in reporting to OSU's federal auditing agency (U.S. Department of Health and Human Services) for the upcoming base rate renegotiation year.

Establish nimble and sustainable programs

The COVID-19 pandemic pressed OSU's research enterprise to its limits, revealing areas of strength and resilience as well as exposing limitations and weaknesses.

Many research projects were impacted due to the lack of access to research sites or subjects, difficulties interacting with collaborators and peers, demands of rapidly transitioning to remote teaching, and the added stresses for individuals who assumed additional caregiving responsibilities. The interruptions to the research enterprise impact faculty, technicians, and graduate students in differing ways. Faculty at or near the transition points of promotion or tenure are impacted more immediately, as are those who have had to take on significant extra duties both at work (re-configuring lab schedules, helping students

re-imagine theses) or at home (childcare, home-schooling, elderly or sick care) or both. National studies have indicated that many of these impacts disproportionately impacted individuals from underrepresented groups. OSU quickly acknowledged these impacts and put in place additional flexibilities and considerations within the promotion and tenure process.

The pandemic also demonstrated the need for nimble administrative infrastructures. The human research protection, animal safety, and biosafety programs, in coordination with advisory committees and researchers, oversaw the scaling back and resumption of research, helping to ensure the safety and welfare of researchers and research subjects. The HRPP in particular was significantly strained as TRACE OSU was called on to conduct prevalence testing at new locations, often requiring the researchers and HRPP staff to develop, review, and approve new research protocols in incredibly short timelines. The RO is reviewing its programs with an eye to building more nimble, sustainable programs.

There are likely other impacts due to COVID-19 that are yet to materialize. For example, any decrease in proposal submissions will affect award numbers six to nine months down the line. OSU will need to find ways of mitigating these downstream impacts, such as with expanded seed funding, teaching releases, and additional targeted research development and support activities.