

FISCAL YEAR 2020

RESEARCH AND TECHNOLOGY TRANSFER ACTIVITY REPORT





ABOUT THIS REPORT

The Arizona Board of Regents' Research and Technology Transfer Activity Report is an annual report examining the research and technology transfer activities at Arizona's public universities, including the facilities used and personnel engaged to support these activities. Research expenditures are reported in total, by funding source and research discipline. Research expenditures data is complimented with comparative national market share and rankings information. The technology transfer activities reported span the technology transfer process from discovery through commercialization.

Data in this report utilizes the definitions and standards established by related national surveys. Research expenditures and research personnel are reported consistent with the National Science Foundation's annual Higher Education Research and Development Survey. Research facilities data reflect the National Science Foundation's biannual Survey of Science and Engineering Research Facilities. Technology transfer activities are reported under the Association of University Technology Managers' annual Licensing Activity Survey standards.

The technology transfer portions of this report are required by ABOR Policy 6-909.10.

ABOUT THE ARIZONA BOARD OF REGENTS

The Arizona Board of Regents is committed to ensuring access for qualified residents of Arizona to undergraduate and graduate institutions; promoting the discovery, application, and dissemination of new knowledge; extending the benefits of university activities to Arizona's citizens outside the university; and maximizing the benefits derived from the state's investment in education.

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EXECUTIVE SUMMARY

Research focused on COVID-19 was instrumental to the state's response to and management of the pandemic during fiscal year 2020. From creating a clinically approved and certified COVID-19 testing lab in two weeks to making 3D personal protective equipment when it was in short supply, creating a smartphone based test for the virus and the state's first FDA-approved saliva-based test, the universities' research efforts proved critical to the state. Through the Arizona COVID-19 Genomics Union, the state's public universities and the Translational Genomics Research Institute (TGen) are tracking the virus, how it evolves and spreads.

Pivoting the efforts of hundreds of researchers at the universities to aid in the pandemic was crucial, yet the research enterprise accomplished additional major milestones during the year. OSIRIS-REx travelled to the asteroid Bennu and collected a sample before beginning the long trek back to Earth. Research at the universities encompassed issues affecting Arizona today – forest and ecosystem health, fighting obesity, predicting climate trends and heat waves, addressing health inequities, filling critical gaps in health care and advancing cybersecurity among myriad additional innovations at the universities.

A core mission among Arizona's public universities is the discovery of new knowledge, and all three of the universities are internationally recognized for their research activity. Arizona State University and the University of Arizona are among the nation's elite 131 universities classified as "R1: Doctoral Universities - Very High Research Activity," and Northern Arizona University is among the nation's exceptional 135 universities designated "R2: Doctoral Universities - High Research Activity."¹

The universities' research missions are crucial as the research created at Arizona's public universities is an essential part of Arizona's economic future and the means by which new technologies are created and discoveries are made, thereby enhancing the lives of Arizonans. The universities' research activities in fiscal year 2020 also provided wages and tuition support for almost 20,000 faculty, staff and students.

Research expenditures across Arizona's public universities continue to grow. In fiscal year 2020, Arizona public universities research activity – as measured by research expenditures – grew year-over-year by \$55.1 million or 3.8 percent to exceed \$1.488 billion.

Arizona State University

ASU continues its decade-long trend of being one of the fastest growing research enterprises in the country. The university's research activity – as measured by research expenditures – totaled over \$673.4 million in fiscal year 2020, exceeding fiscal year 2019's expenditures by \$33.8 million or 5.3 percent. While ASU missed this year's projected metric target, the institution has surpassed annual metric targets for the past nine years and has cumulatively exceeded its goals by \$185 million over the past decade.

ASU's total research expenditures ranking continued to improve, rising from 44th in 2016 to 43rd in 2019 among all U.S. universities and from 27th in 2016 to 26th in 2019 among public universities. ASU is now ranked sixth nationally in total research expenditures for universities without a medical school.

ASU ranked third in NASA funded expenditures and 23rd in National Science Foundation funded expenditures.

¹ See The Carnegie Classification of Institutions of Higher Education at <https://carnegieclassifications.iu.edu/index.php>

ASU is ranked among the top 10 universities in research expenditures in the disciplines of social sciences and geosciences, atmospheric and ocean sciences, and is the No. 1 university in the country in research expenditures for transdisciplinary, multidisciplinary and other sciences expenditures. ASU is also ranked among the top 30 universities in research expenditures in computer science, engineering, mathematics and statistics, psychology, and non-science and engineering disciplines.

ASU's top disciplines for research expenditures are transdisciplinary, multidisciplinary and other sciences, geological and Earth sciences, and biological and biomedical sciences as well as electrical, electronic and communications engineering.

ASU's technology transfer and commercialization activities garnered worldwide recognition, including ranking 10th for U.S. patents issued to U.S. universities. The university entered into 78 license and option agreements in 2020, which was slightly down from fiscal year 2019, but exceeded its annual metric target of 70 agreements. ASU's invention disclosures, U.S. patents issued, and startup companies formed all increased.

Northern Arizona University

NAU continued its steady growth in research. The university's research activity – as measured by research expenditures – totaled over \$64.5 million in fiscal year 2020, surpassing its fiscal year 2019 expenditures by \$5.6 million or 9.5 percent. The university exceeded its fiscal year 2020 annual metric target by \$25 million, and over the past decade the university has grown its annual research expenditures by \$35.7 million or 124 percent.

The university's total research expenditure ranking rose significantly, improving from 213th in 2016 to 191st in 2019 among all U.S. universities and 156th in 2016 to 139th in 2019 among U.S. public universities.


NAU is ranked 68th in USDA funded research, and 87th in NASA funded research. NAU also ranks 79th nationally in geoscience, atmospheric and ocean sciences. NAU significantly improved its ranking in computer sciences, increasing from 296th in 2016 to 126th in 2019.

The university's top disciplines for research expenditures are in biological and biomedical sciences, health sciences, and natural resources and conservation.

In technology transfer, NAU again exceeded its enterprise goal for invention disclosures in 2020, receiving 43 disclosures - 10 more than their goal for the fiscal year. New patent applications, U.S. patents received, and licenses and options executed all remained steady, and NAU formed its first startup since 2017.

University of Arizona

UArizona experienced a substantial increase in its research over the prior three years. In fiscal year 2020, the university's research activity – as measured by research expenditures – totaled \$750.1 million, surpassing its fiscal year 2019 expenditures by \$15.8 million or 2.2 percent and exceeding its enterprise goal for the year by \$96.4 million. The university's annual research expenditures have increased by \$163.5 million or 27.9 percent over the past decade.



UArizona's total research expenditure ranking continues to improve, rising from 38th in 2016 to 34th in 2019 among all U.S. universities, and from 23rd in 2016 to 19th in 2019 among U.S. public universities.

The university is ranked sixth in NASA funded research, 26th in USDA funded research and 28th in National Science Foundation funded research.

UArizona continued to improve its national rankings in physical sciences from sixth in 2016 to fourth in 2019 and maintained top 50 rankings in computer sciences, geosciences, atmospheric and ocean sciences, life sciences, social sciences, and transdisciplinary, multidisciplinary and other sciences.

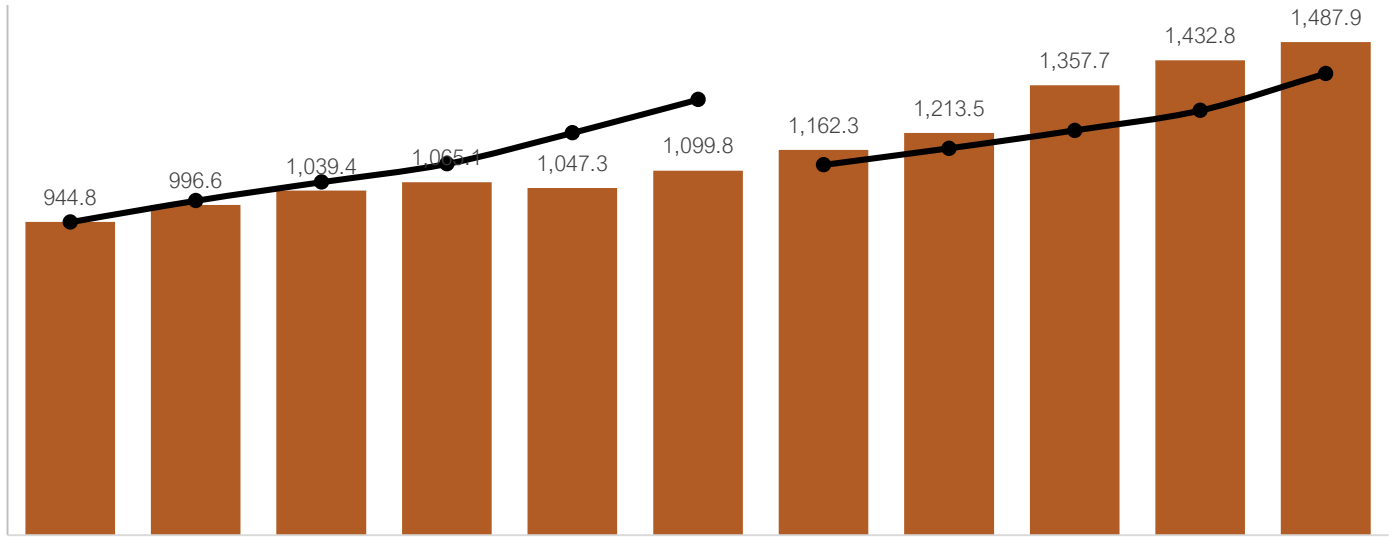
The university's top disciplines for research expenditures are biological and biomedical sciences, health sciences, and astronomy and astrophysics.

UArizona's technology transfer and commercialization activities remained steady in fiscal year 2020. The university entered into 95 license and option agreements. This is in line with the number of licenses and options executed in fiscal year 2019, but nine agreements short of its metric target for the year. Licensing and options income however, increased from \$5.9 million to \$7.3 million year-over-year, extending its continuous advance from \$2 million in 2016. In fiscal year 2020, UArizona was also issued 87 U.S. patents – an increase of 31 from 2019, and the university formed 19 startups.

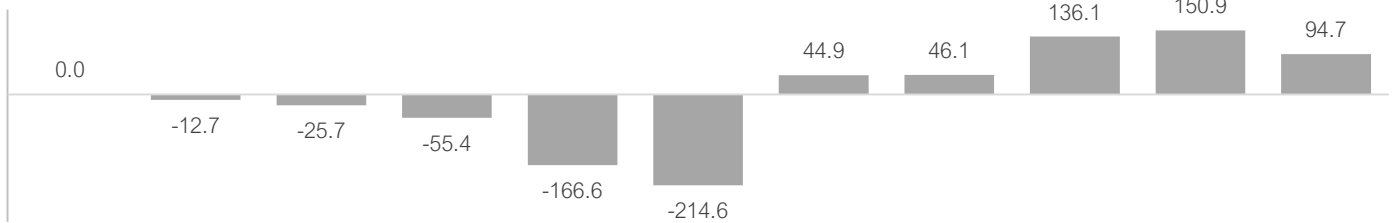
Arizona Public University Enterprise

Exhibit E.R.1: Total Research Expenditures and Enterprise Goals

Total Research Expenditures and Enterprise Goals in Millions



Actual to Enterprise Goal Differences in Millions



Cumulative Actual to Enterprise Goal Differences in Millions

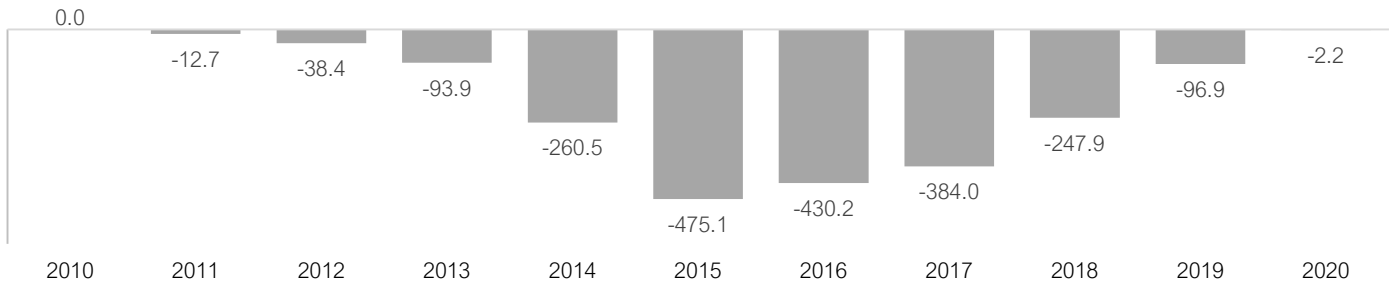
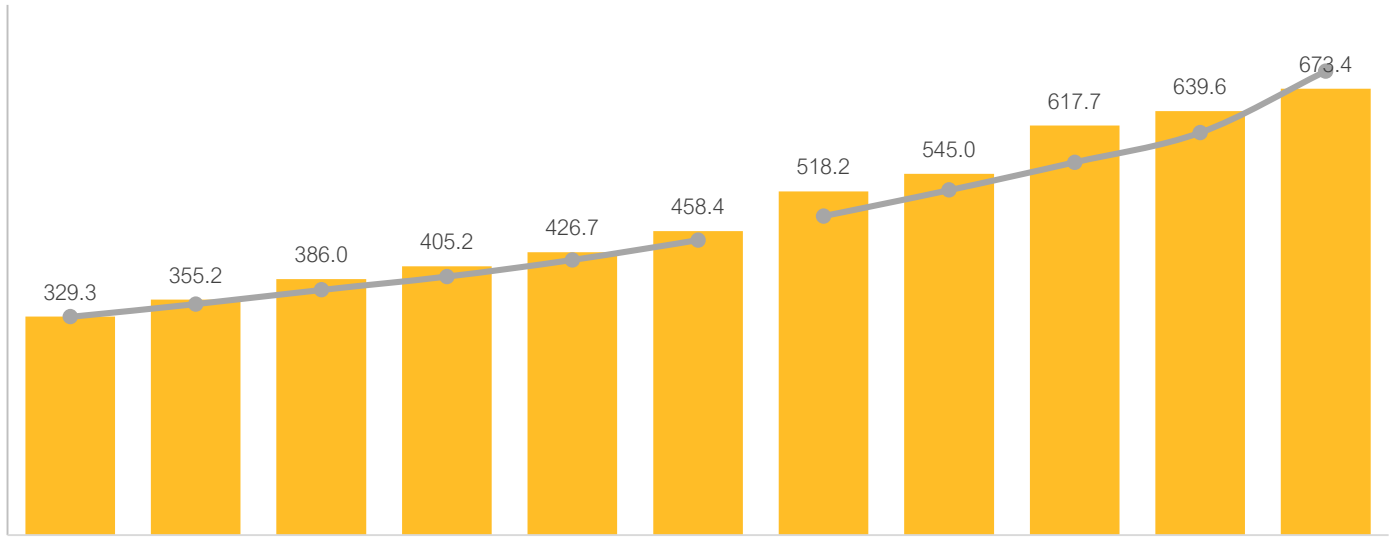
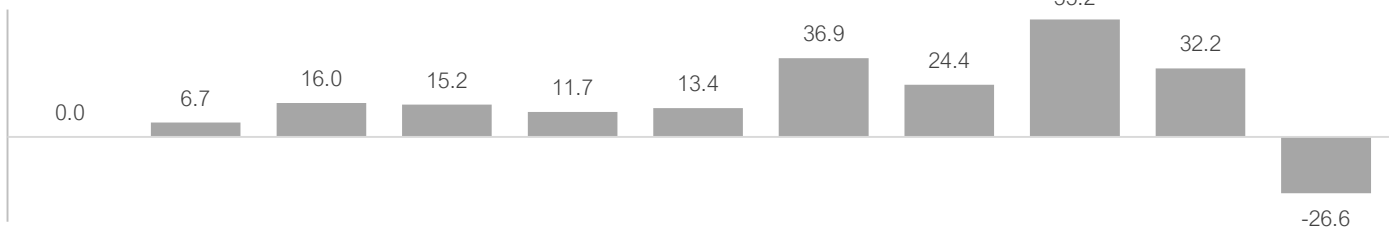


Exhibit ASU.R.1: Research Expenditures and Enterprise Goals

Research Expenditures and Enterprise Goals in Millions



Actual to Enterprise Goal Differences in Millions



Cumulative Actual to Enterprise Goal Differences in Millions

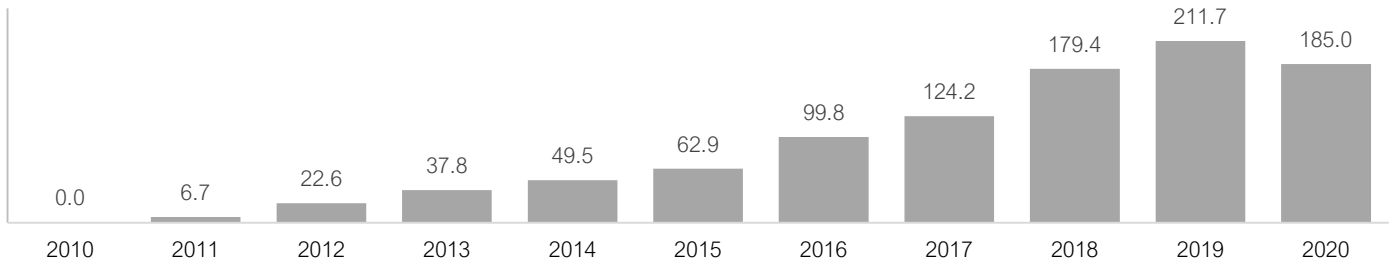
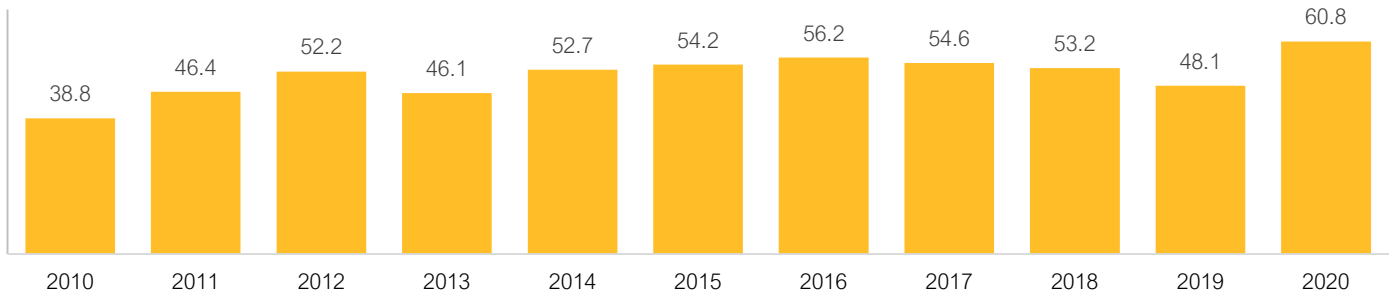


Exhibit ASU.R.2: Other Sponsored Project Expenditures

Other Sponsored Project Expenditures in Millions



Arizona State University

Exhibit ASU.R.3: Research Expenditures National Comparisons

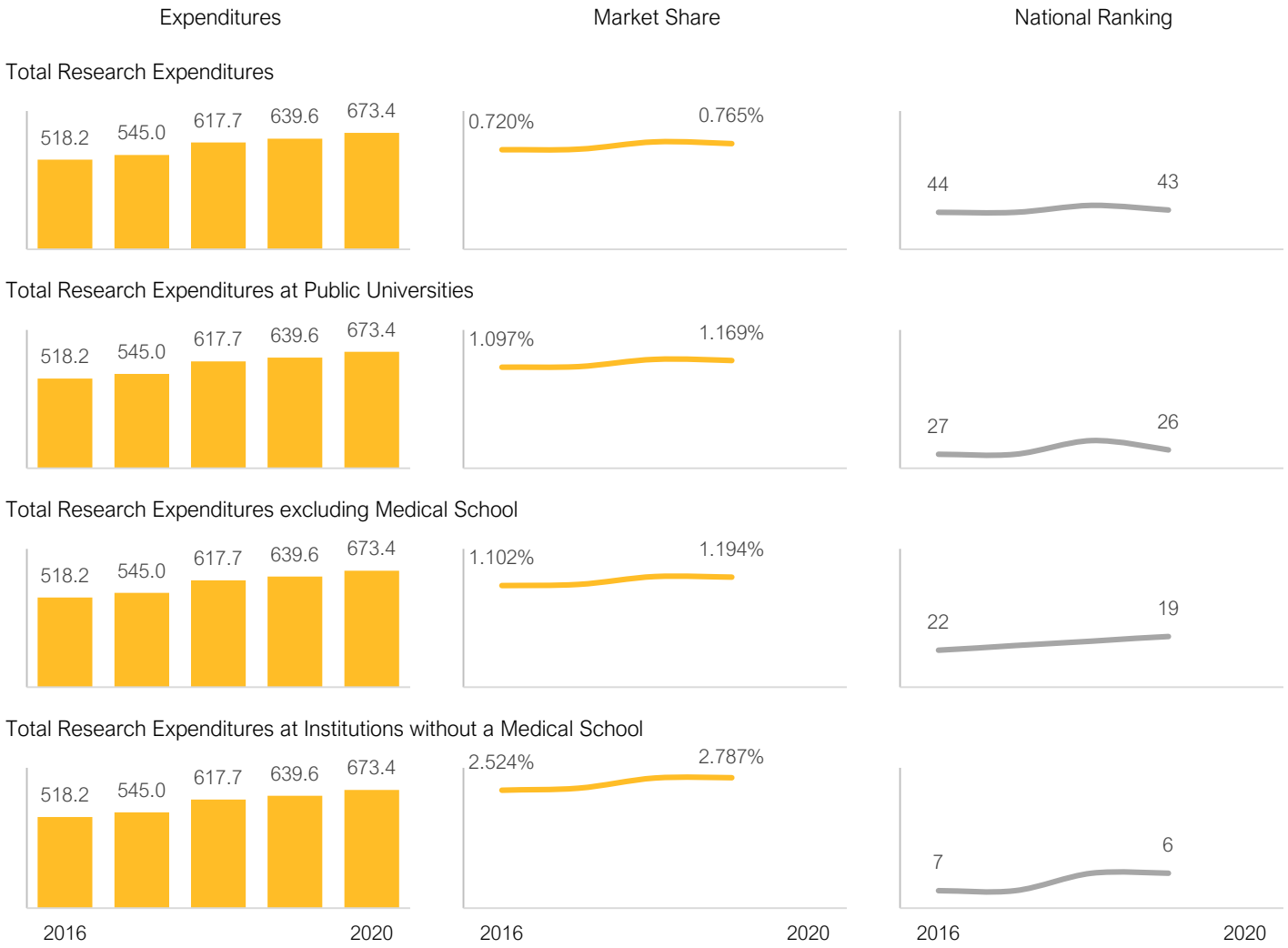
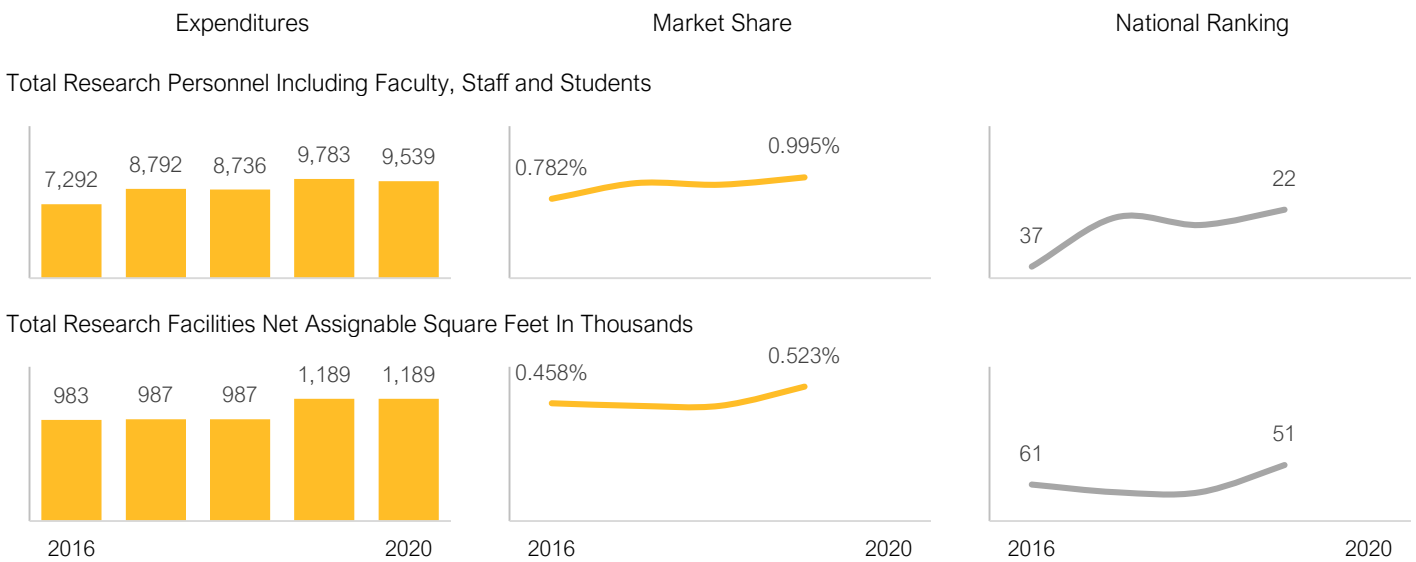
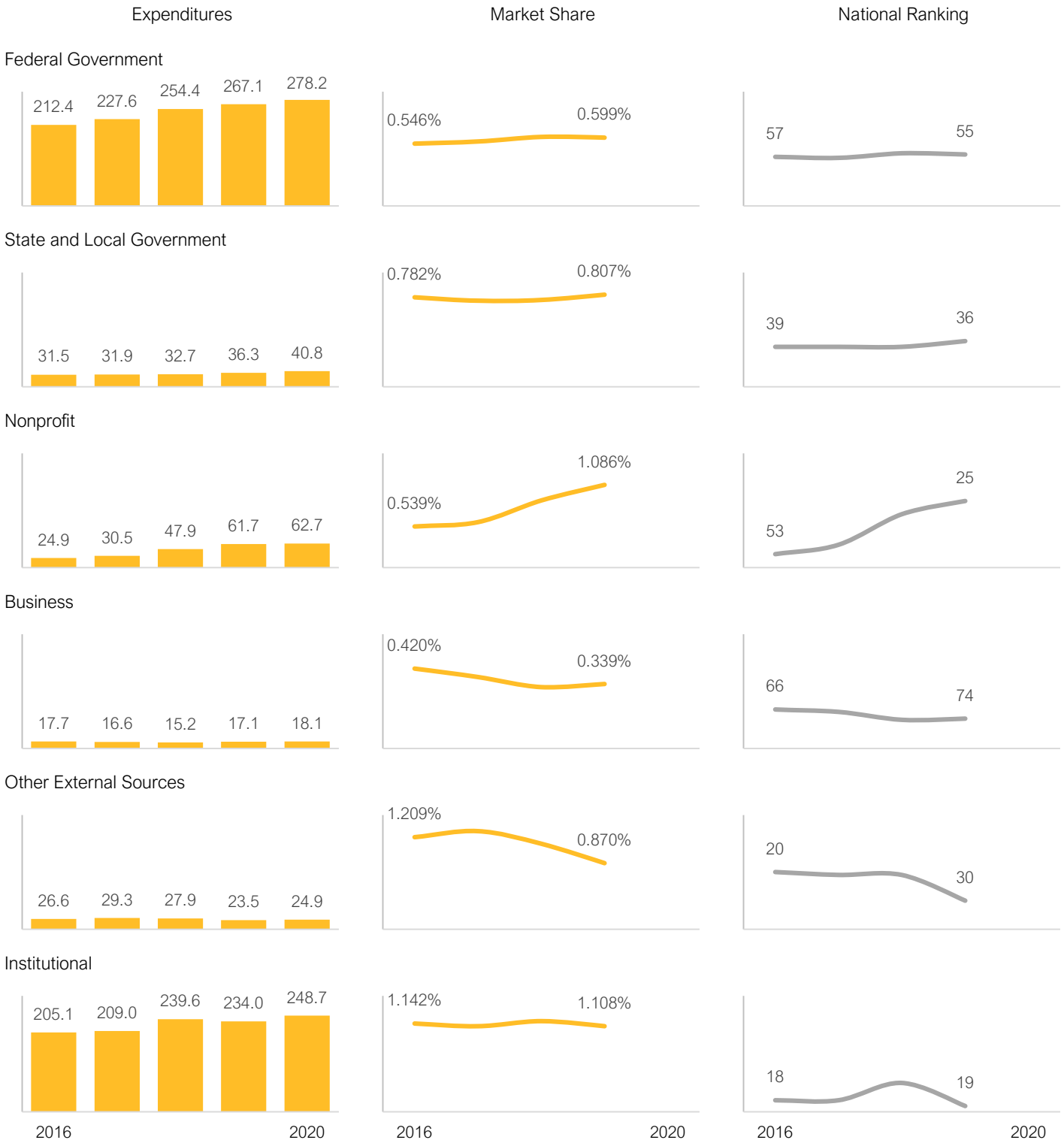


Exhibit ASU.R.4: Research Personnel and Facilities



Arizona State University

Exhibit ASU.R.5: Research Expenditures by Sponsor Group



Arizona State University

Exhibit ASU.R.6: Federal Research Expenditures by Federal Agency

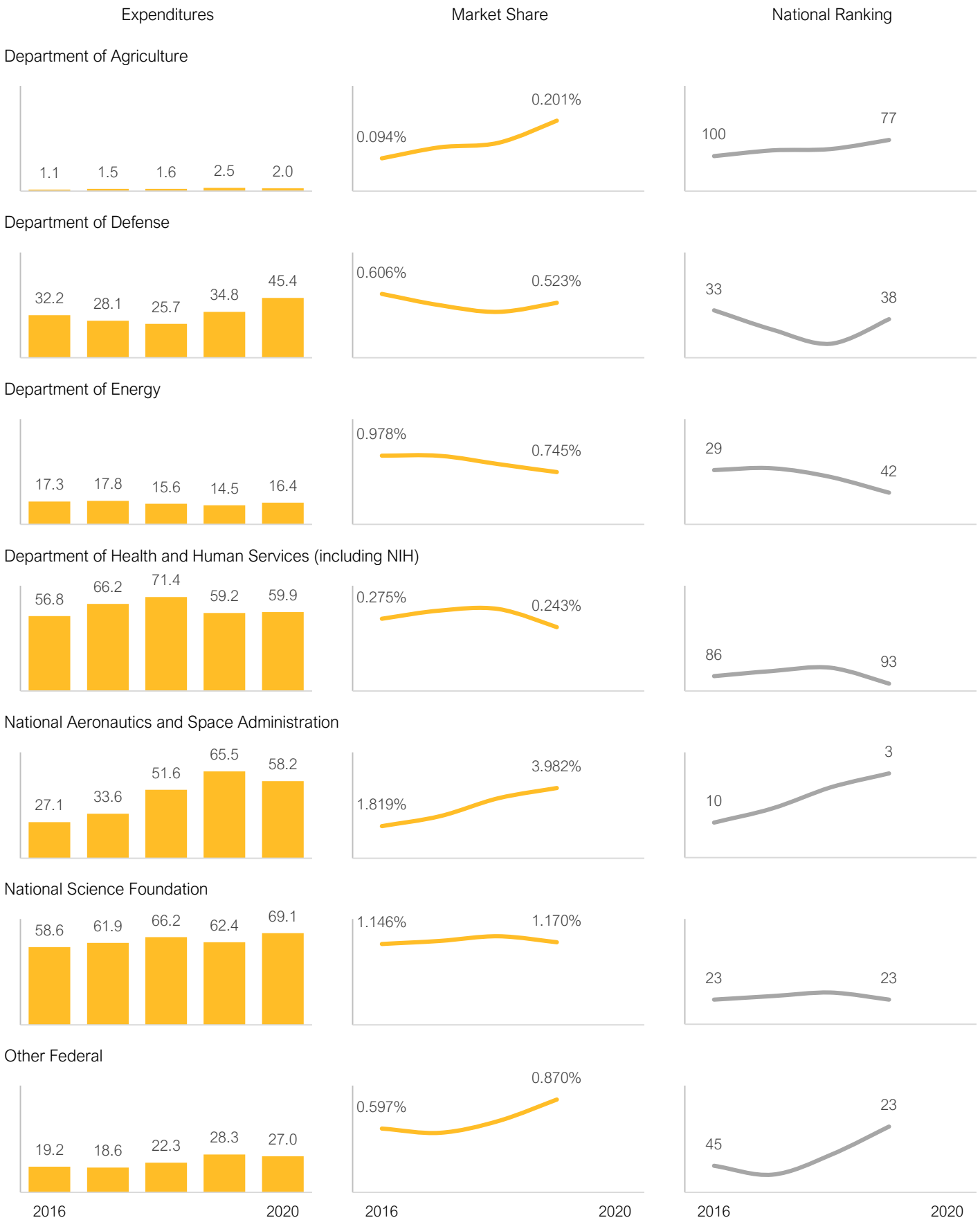
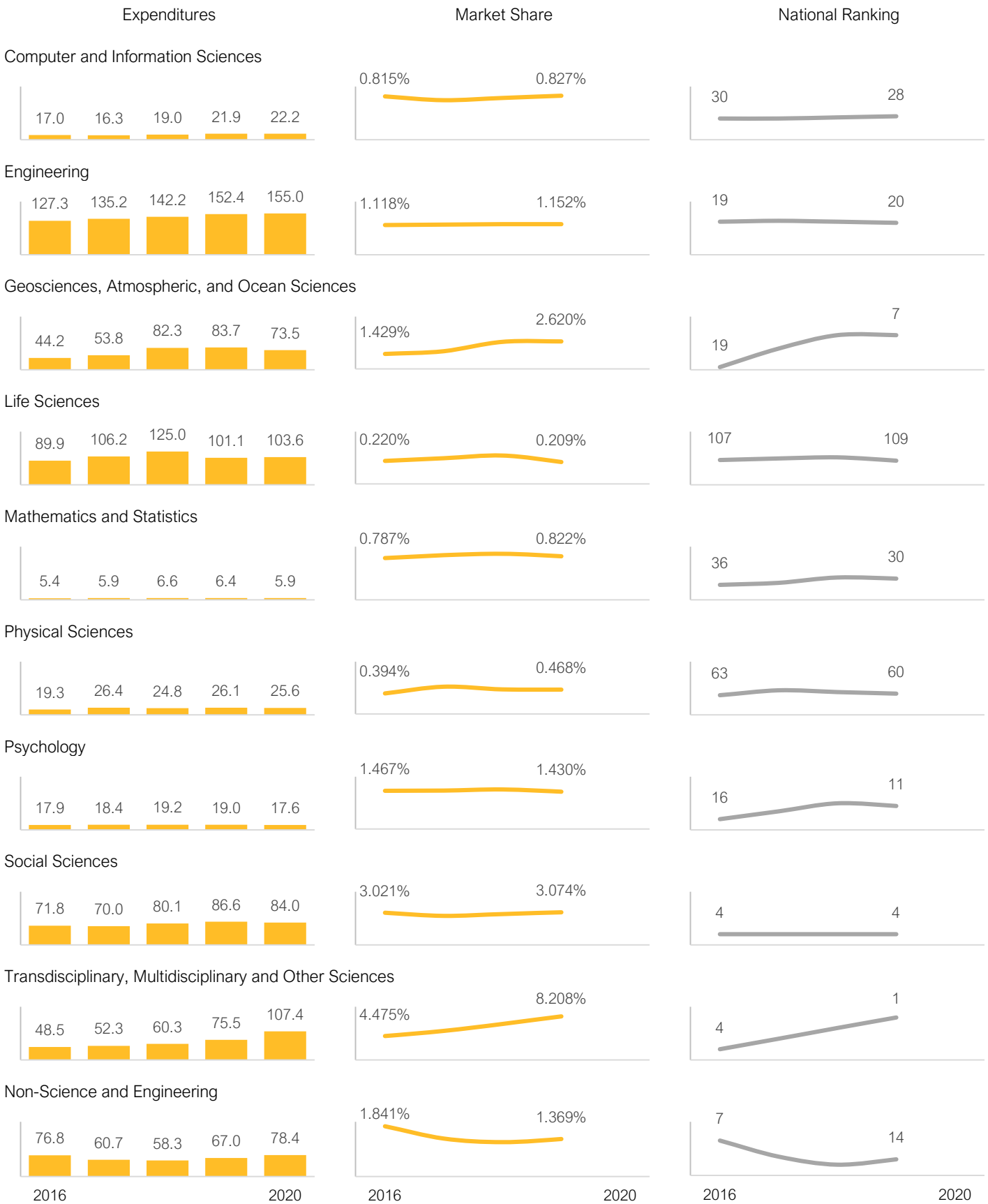


Exhibit ASU.R.7: Total Research Expenditures by Broad Discipline



Arizona State University

Exhibit ASU.R.8: Total Research Expenditures by Detailed Discipline

































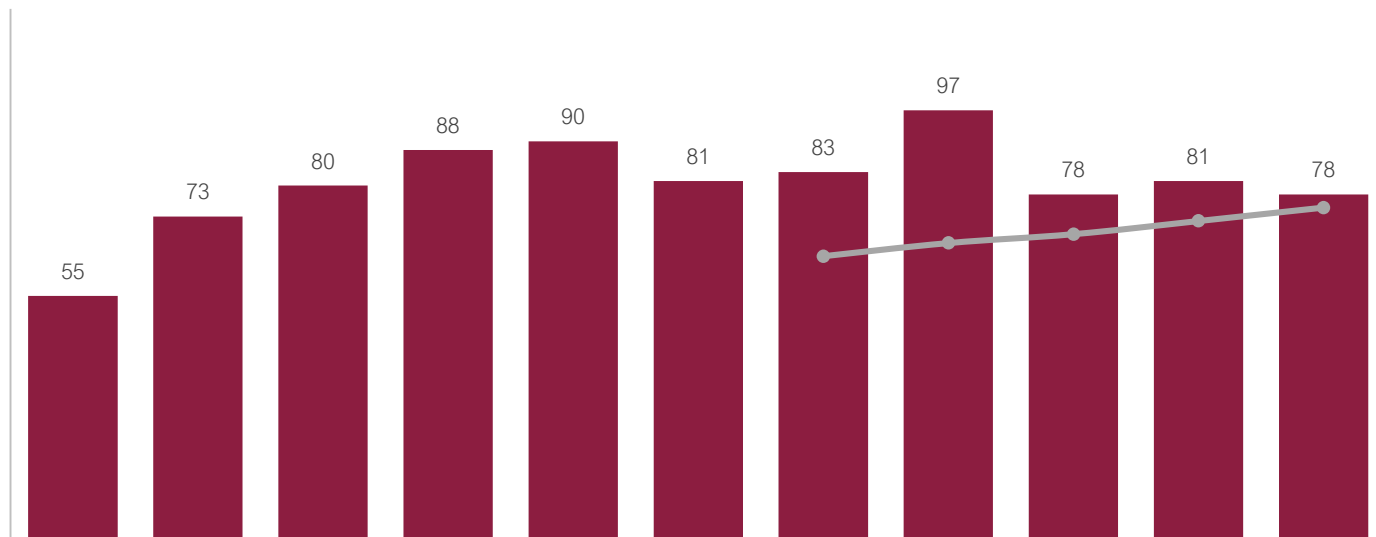
Research Discipline	2020 Expenditures	% of Discipline	% of Total
Computer and Information Sciences	22,231,000	100.0%	3.3%
Computer and Information Sciences	22,231,000 	100.0%	3.3%
Engineering	155,015,000	100%	23.0%
Aerospace, Aeronautical and Astronautical Engineering	0	0.0%	0.0%
Bioengineering and Biomedical Engineering	12,067,000 	7.8%	1.8%
Chemical Engineering	6,998,000 	4.5%	1.0%
Civil Engineering	26,738,000 	17.2%	4.0%
Electrical, Electronic and Communications Engineering	52,719,000 	34.0%	7.8%
Industrial and Manufacturing Engineering	3,092,000 	2.0%	0.5%
Mechanical Engineering	11,303,000 	7.3%	1.7%
Metallurgical and Materials Engineering	6,100,000 	3.9%	0.9%
Other Engineering	35,998,000 	23.2%	5.3%
Geosciences, Atmospheric and Ocean Sciences	73,544,000	100.0%	10.9%
Atmospheric Science and Meteorology	0	0.0%	0.0%
Geological and Earth Sciences	73,544,000 	100.0%	10.9%
Ocean Sciences and Marine Sciences	0	0.0%	0.0%
Other Geosciences, Atmospheric, and Ocean Sciences	0	0.0%	0.0%
Life Sciences	103,558,000	100.0%	15.4%
Agricultural Sciences	0	0.0%	0.0%
Biological and Biomedical Sciences	63,293,000 	61.1%	9.4%
Health Sciences	39,268,000 	37.9%	5.8%
Natural Resources and Conservation	457,000 	0.4%	0.1%
Other Life Sciences	540,000 	0.5%	0.1%
Mathematics and Statistics	5,942,000	100.0%	0.9%
Mathematics and Statistics	5,942,000 	100.0%	0.9%
Physical Sciences	25,619,000	100.0%	3.8%
Astronomy and Astrophysics	0	0.0%	0.0%
Chemistry	13,030,000 	50.9%	1.9%
Materials Science	0	0.0%	0.0%
Physics	12,338,000 	48.2%	1.8%
Other Physical Sciences	251,000 	1.0%	0.0%
Psychology	17,645,000	100.0%	2.6%
Psychology	17,645,000 	100.0%	2.6%
Social Sciences	83,980,000	100.0%	12.5%
Anthropology	14,943,000 	17.8%	2.2%
Economics	8,585,000 	10.2%	1.3%
Political Science and Government	16,566,000 	19.7%	2.5%
Sociology, Demography and Population Studies	4,850,000 	5.8%	0.7%
Other Social Sciences	39,036,000 	46.5%	5.8%
Other Sciences	107,393,000	100.0%	15.9%
Transdisciplinary, Multidisciplinary and Other Sciences	107,393,000 	100.0%	15.9%
Non-Science and Engineering	78,430,000	100.0%	11.6%
Business Management and Business Administration	20,895,000 	26.6%	3.1%
Communication and Communications Technologies	5,797,000 	7.4%	0.9%
Education	29,988,000 	38.2%	4.5%
Humanities	7,714,000 	9.8%	1.1%
Law	4,490,000 	5.7%	0.7%
Social Work	6,217,000 	7.9%	0.9%
Visual and Performing Arts	3,329,000 	4.2%	0.5%
Other Non-Science and Engineering	0	0.0%	0.0%

Exhibit ASU.TTA.1: Licenses and Options Executed and Enterprise Goals

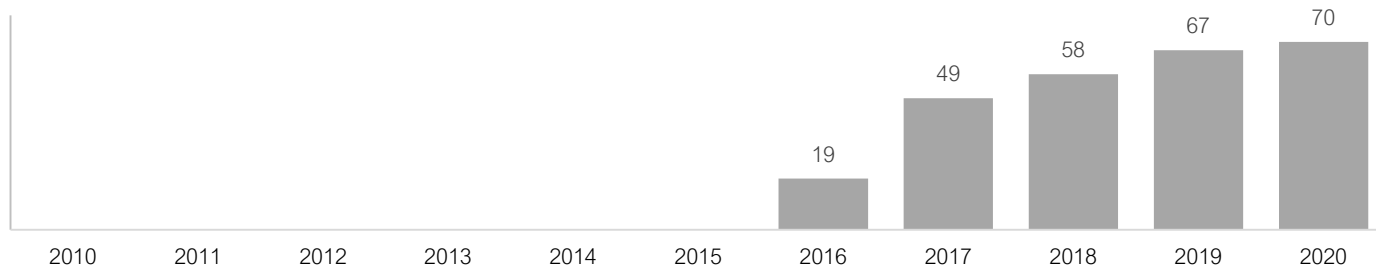
Licenses and Options Executed and Enterprise Goals



Actual to Enterprise Goal Differences



Cumulative Actual to Enterprise Goal Differences



Arizona State University

Exhibit ASU.TTA.2: Invention Disclosures

Invention Disclosures Received

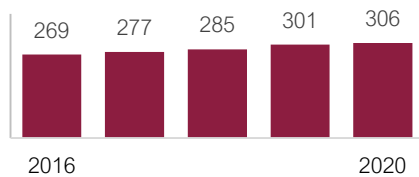
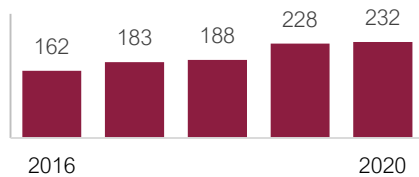


Exhibit ASU.TTA.3: Patents

New Patent Applications



US Patents Issued

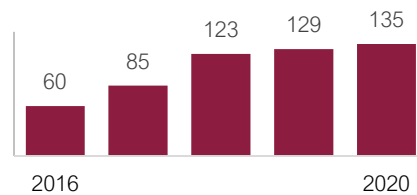
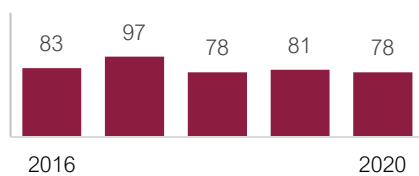
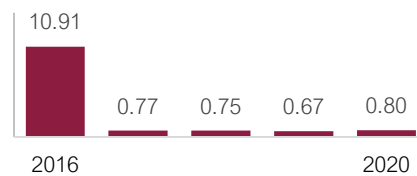


Exhibit ASU.TTA.4: Licenses and Options

Licenses and Options Executed



Licences and Options Income (in Millions)

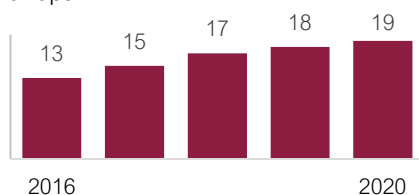


Intellectual Property Income	2016	2017	2018	2019	2020
Licenses and Options Income	10,907,198	770,443	750,757	673,945	801,741
Legal Fees Reimbursed	1,204,692	1,439,171	1,698,294	2,115,725	1,595,385
Other Revenue	357	219,596	3,608	4,827,623	297,664
Total	12,112,247	2,429,210	2,452,659	7,617,293	2,694,790

Royalty Distributions	2016	2017	2018	2019	2020
Inventors	-1,520,699	-188,875	-258,026	-188,069	-133,068
Laboratories and Units	-855,257	-114,923	-149,979	-130,679	-58,690
University	-1,158,996	-119,217	-170,570	-128,903	-92,426
Undistributed	16,878	151,984	14,422	27,200	11,050
Total	-1,997,375	-82,156	-306,127	-232,382	-140,066

Exhibit ASU.TTA.5: Startups

Startups



Cumulative Active Startups

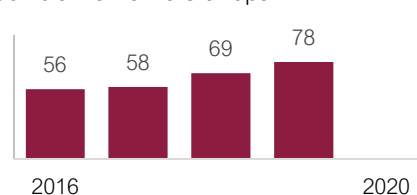
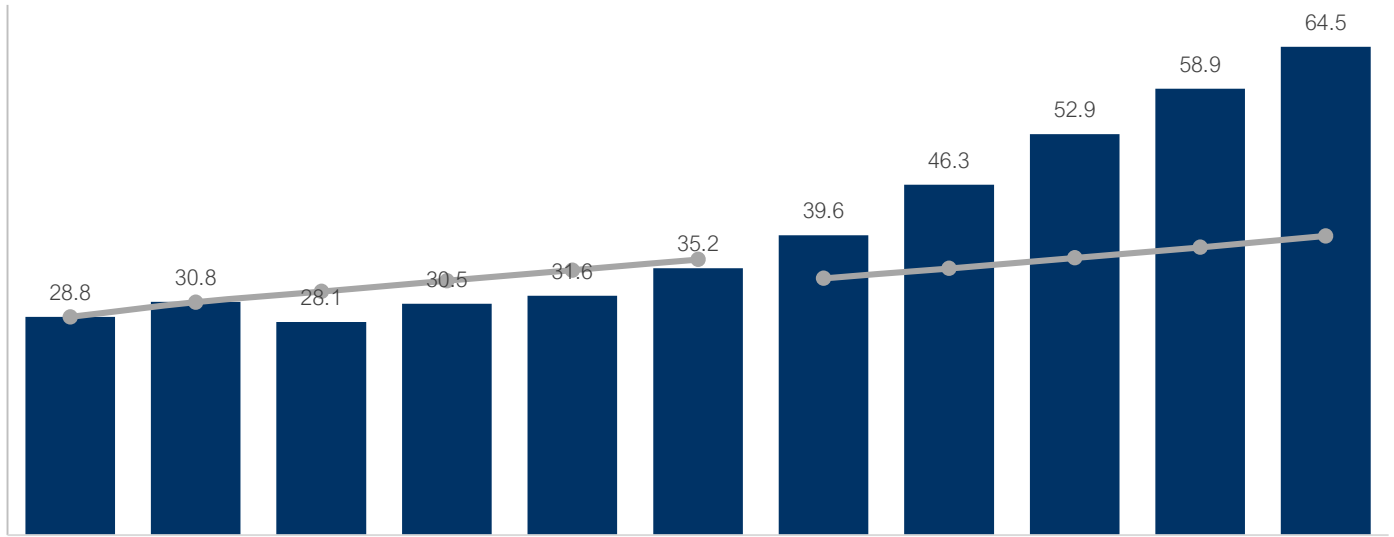
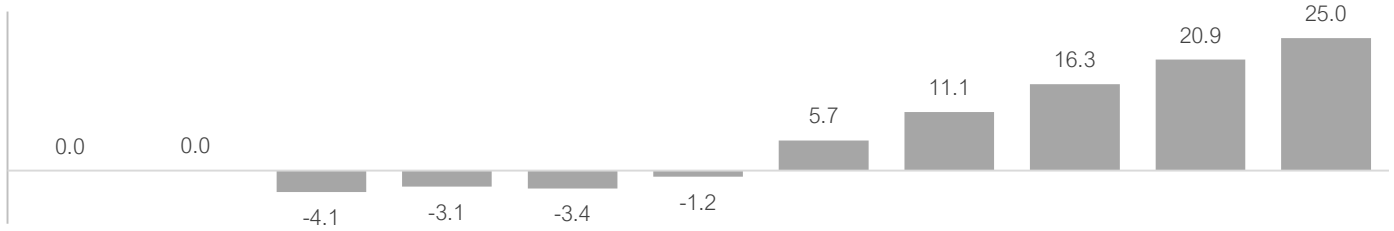


Exhibit NAU.R.1: Research Expenditures and Enterprise Goals

Research Expenditures and Enterprise Goals in Millions



Actual to Enterprise Goal Differences in Millions



Cumulative Actual to Enterprise Goal Differences in Millions

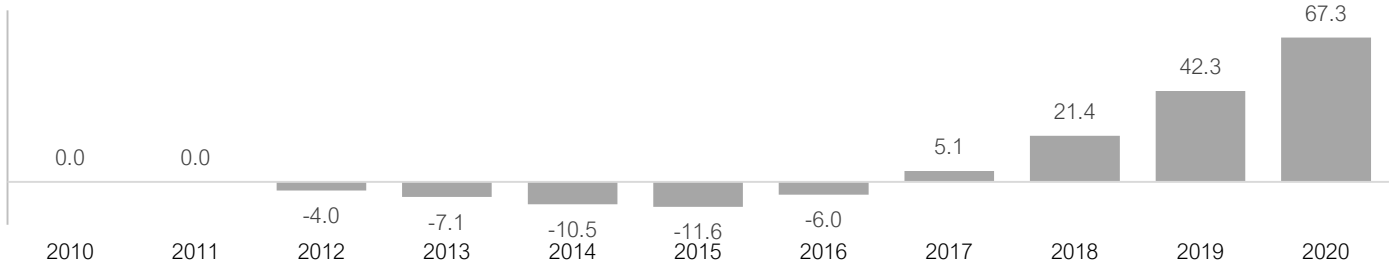
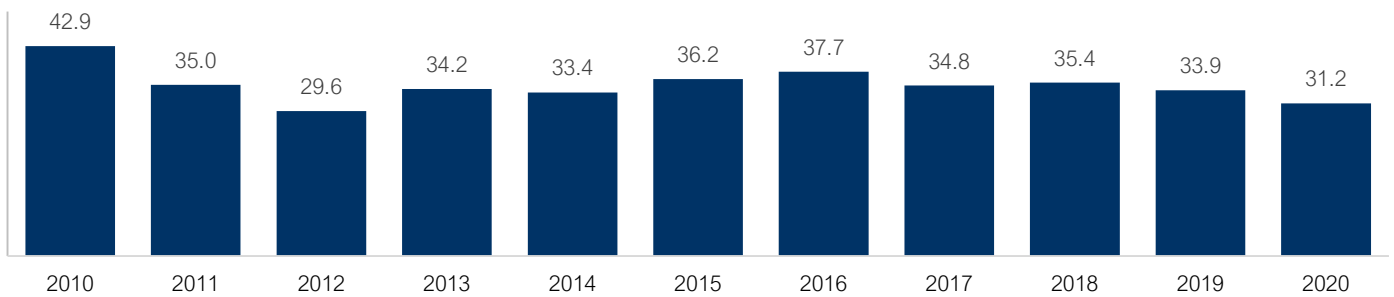


Exhibit NAU.R.2: Other Sponsored Project Expenditures

Other Sponsored Project Expenditures in Millions



Northern Arizona University

Exhibit NAU.R.3: Research Expenditures National Comparisons

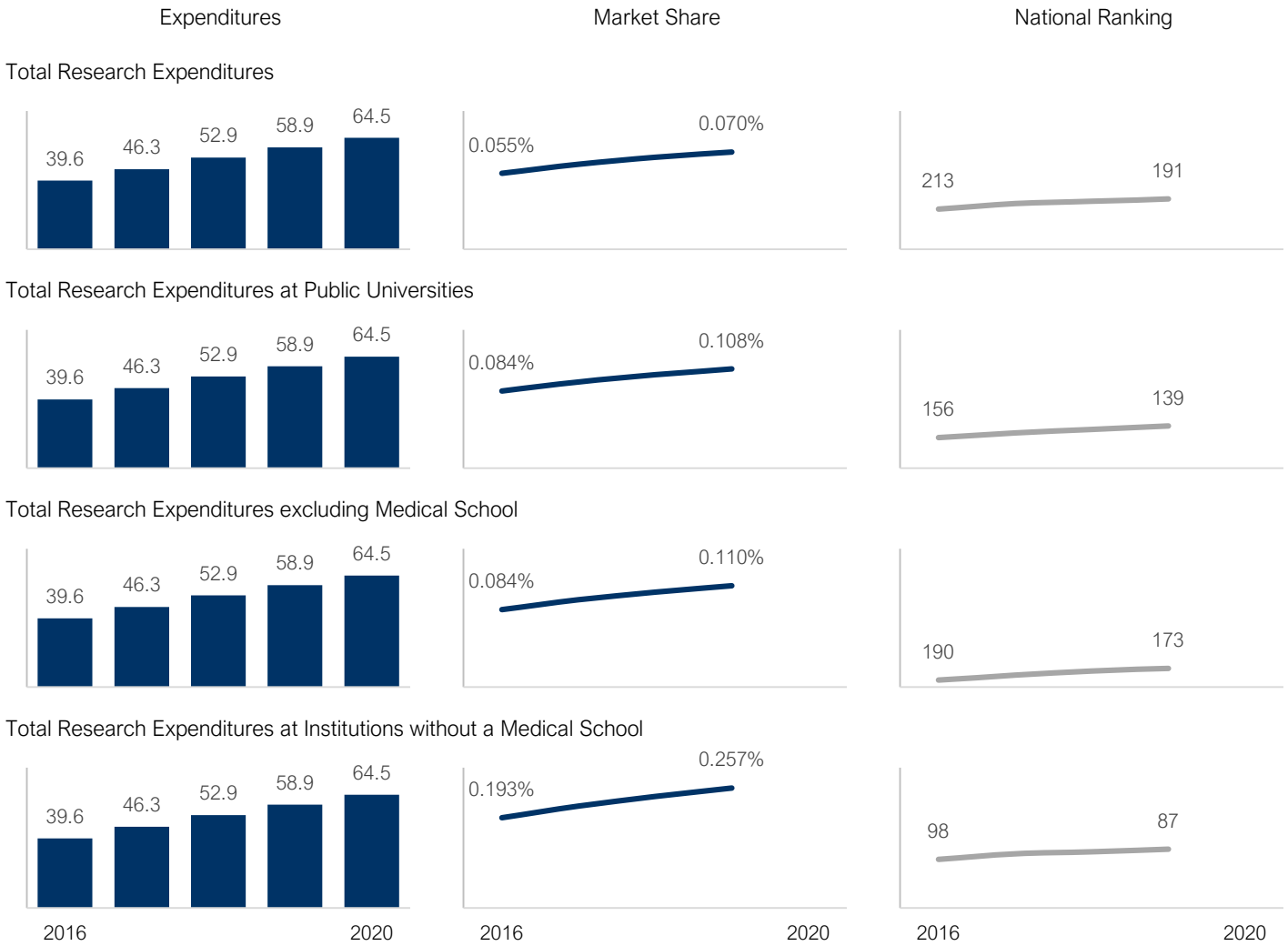
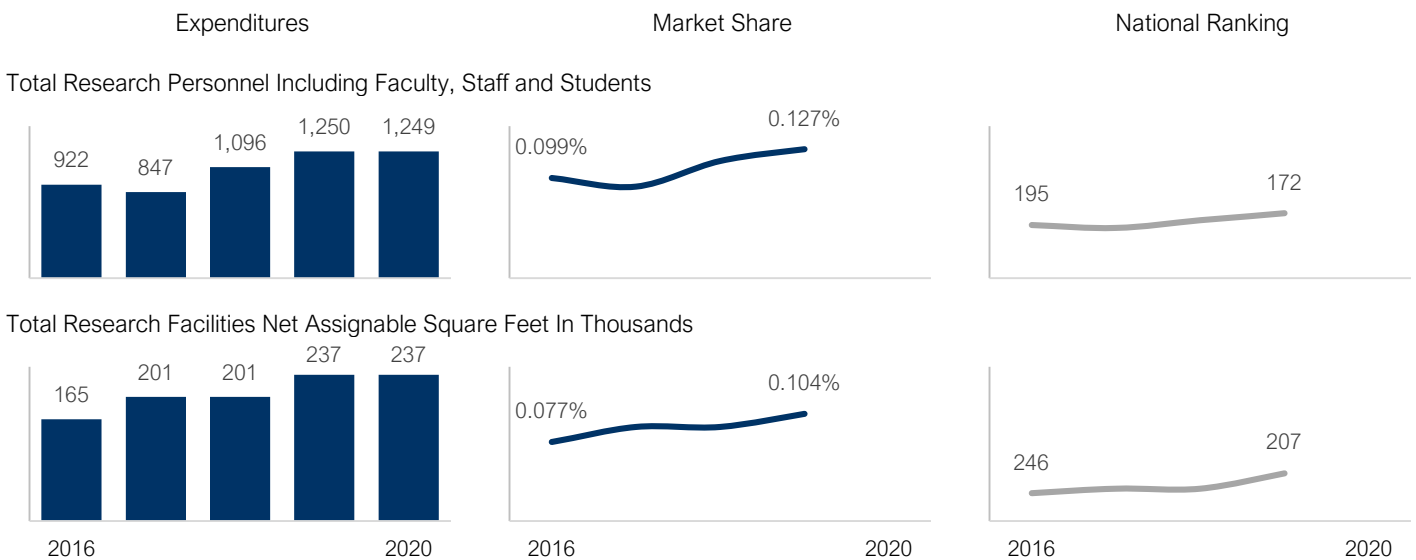
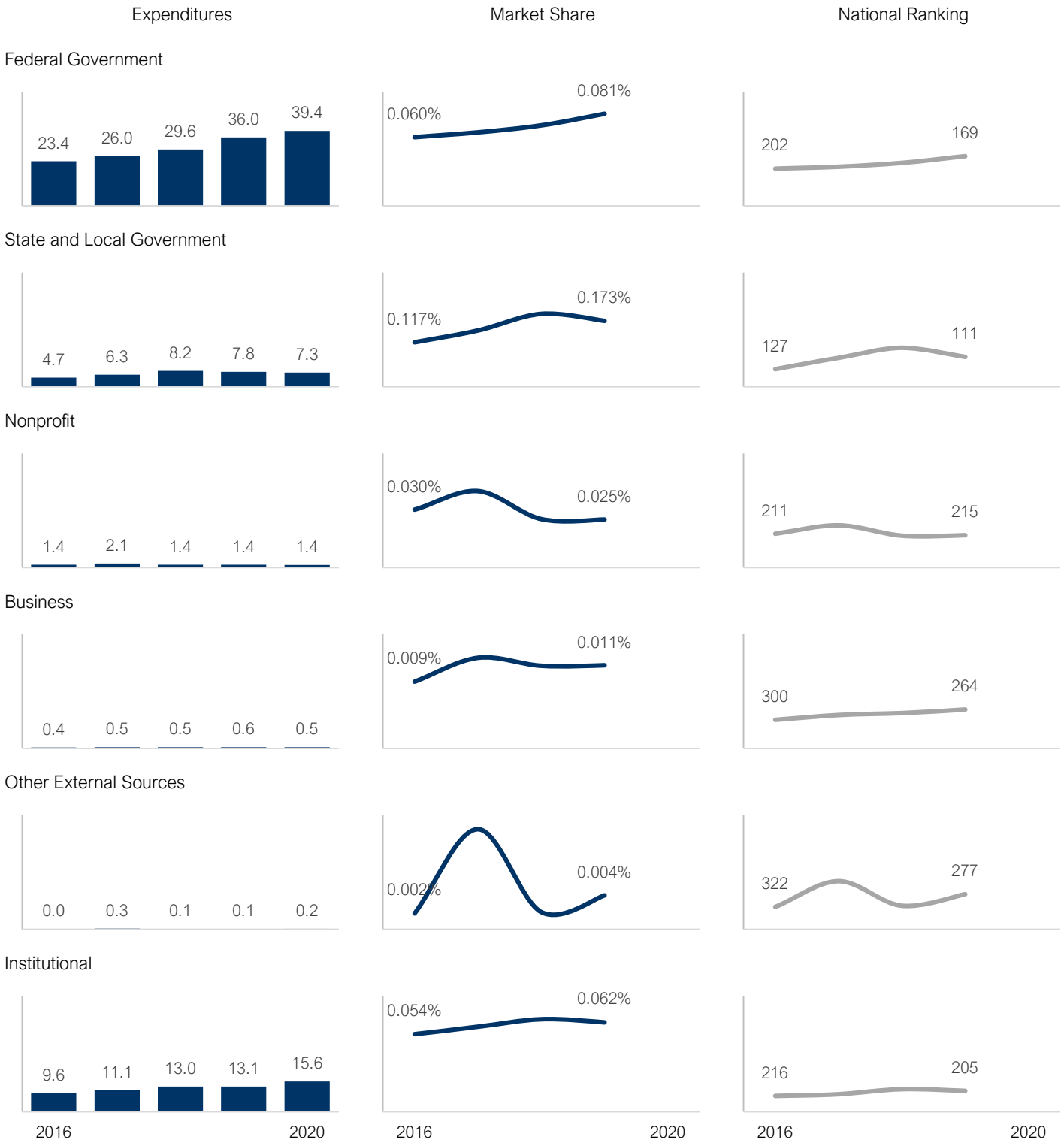


Exhibit NAU.R.4: Research Personnel and Facilities



Northern Arizona University

Exhibit NAU.R.5: Research Expenditures by Sponsor Group



Northern Arizona University

Exhibit NAU.R.6: Federal Research Expenditures by Federal Agency

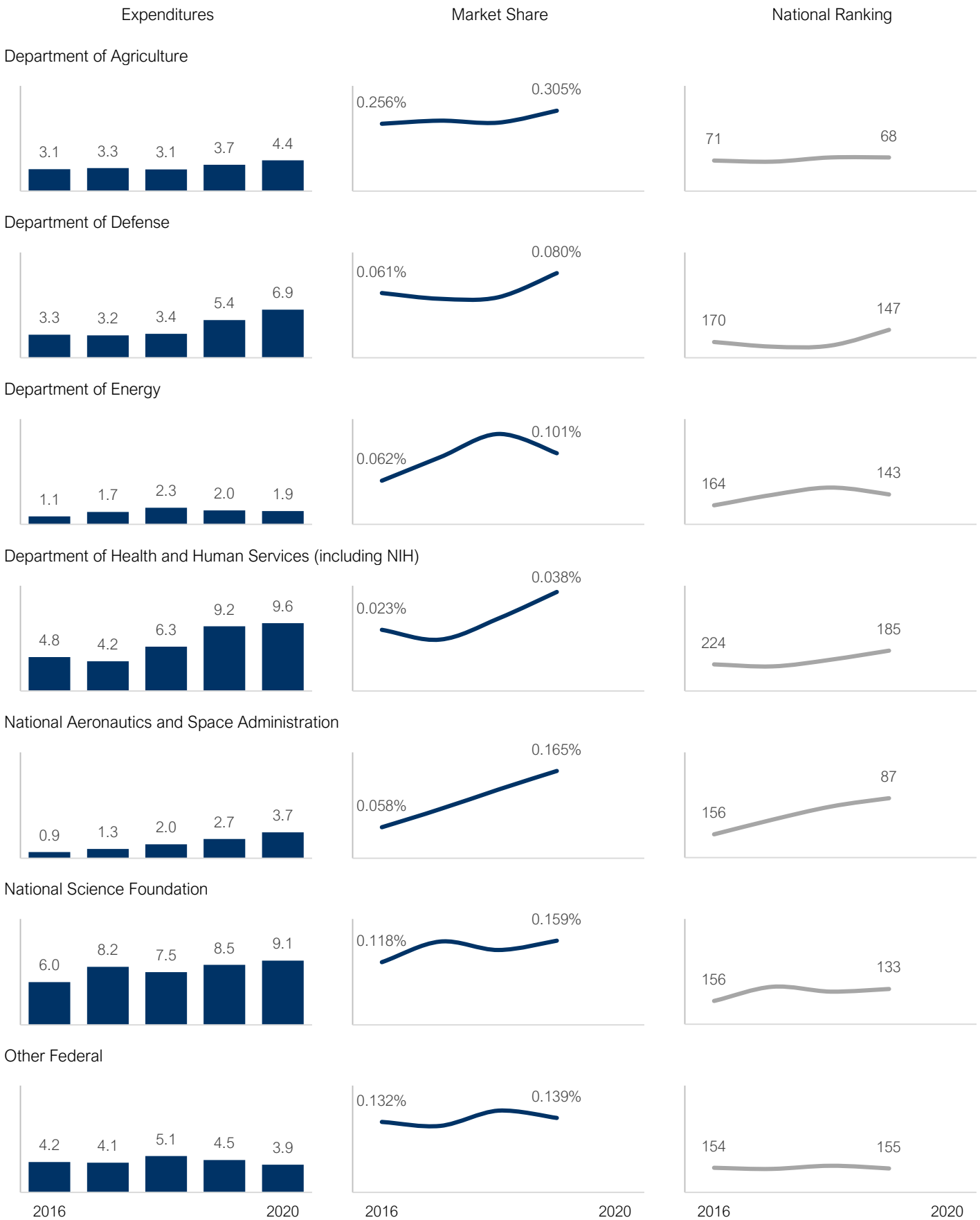
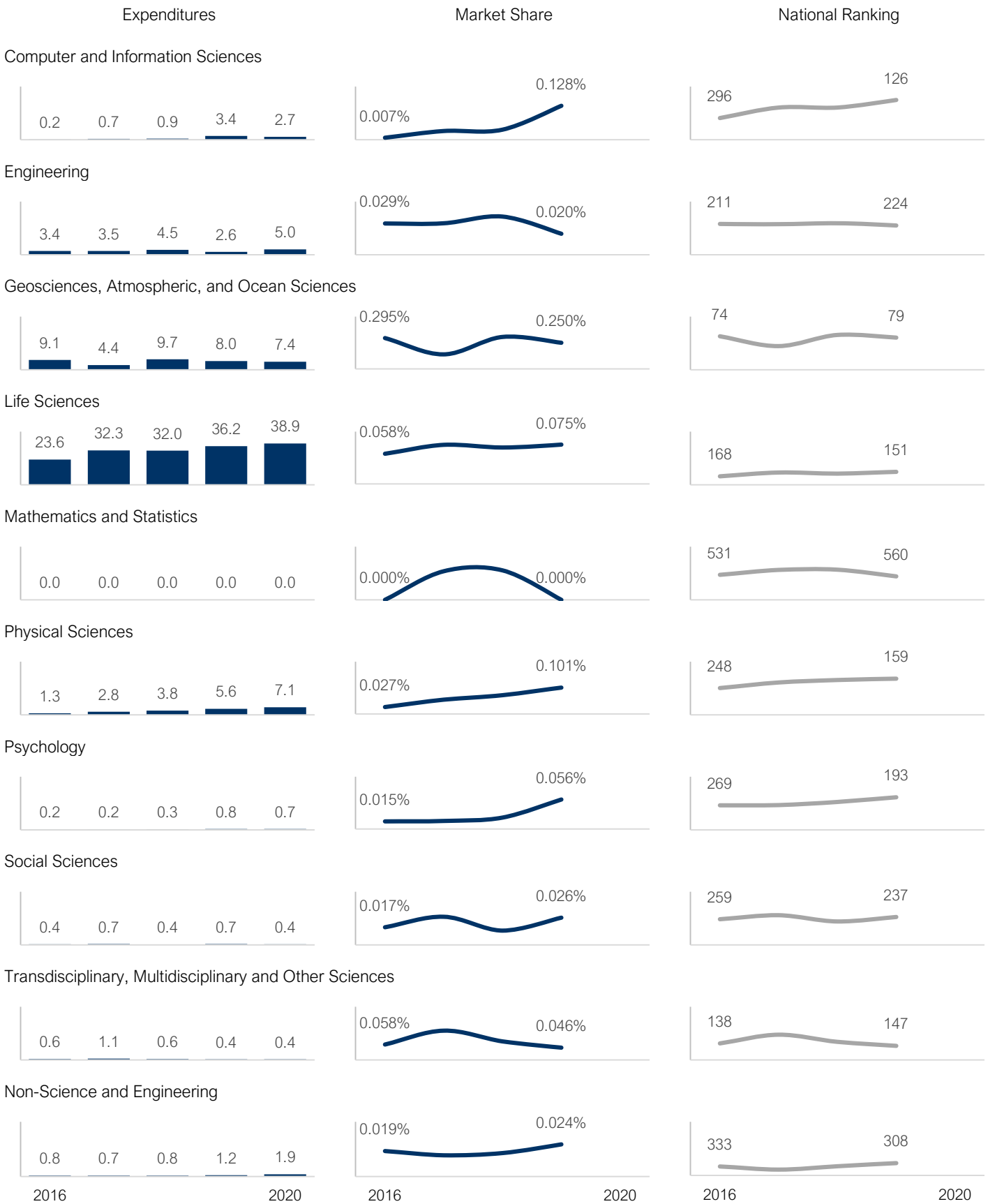


Exhibit NAU.R.7: Total Research Expenditures by Broad Discipline



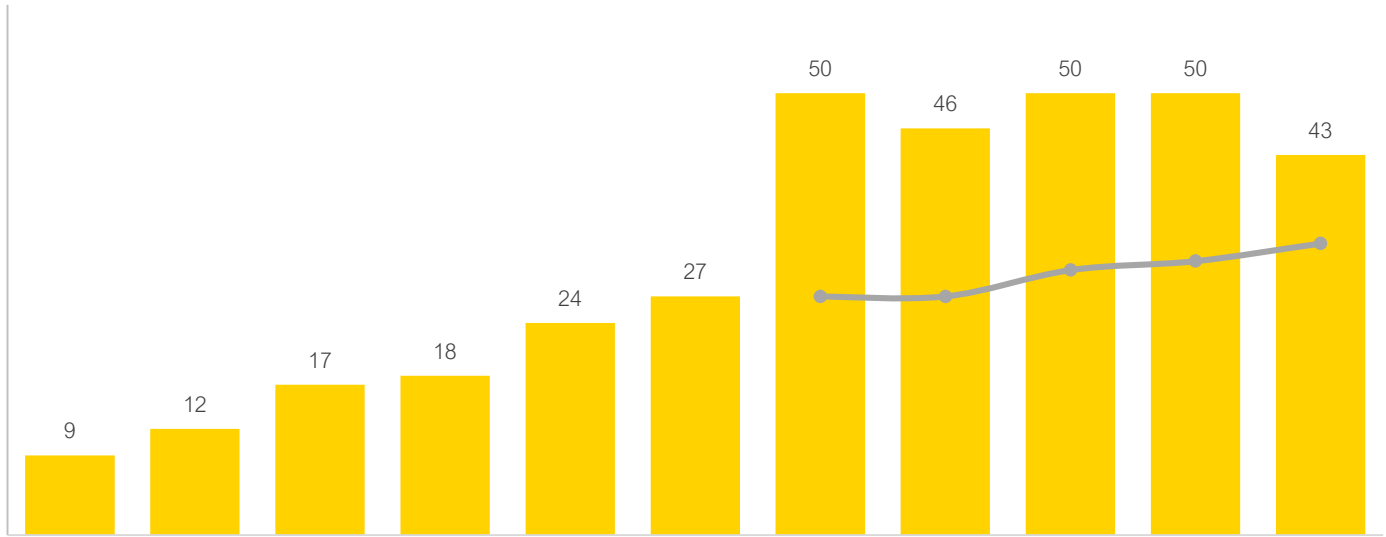
Northern Arizona University

Exhibit NAU.R.8: Total Research Expenditures by Detailed Discipline

Research Discipline	2020 Expenditures	% of Discipline	% of Total
Computer and Information Sciences	2,671,000	100.0%	4.1%
Computer and Information Sciences	2,671,000	100.0%	4.1%
Engineering	4,996,000	100%	7.8%
Aerospace, Aeronautical and Astronautical Engineering	0	0.0%	0.0%
Bioengineering and Biomedical Engineering	1,566,000	31.3%	2.4%
Chemical Engineering	27,000	0.5%	0.0%
Civil Engineering	231,000	4.6%	0.4%
Electrical, Electronic and Communications Engineering	2,172,000	43.5%	3.4%
Industrial and Manufacturing Engineering	0	0.0%	0.0%
Mechanical Engineering	376,000	7.5%	0.6%
Metallurgical and Materials Engineering	41,000	0.8%	0.1%
Other Engineering	583,000	11.7%	0.9%
Geosciences, Atmospheric and Ocean Sciences	7,408,000	100.0%	11.5%
Atmospheric Science and Meteorology	133,000	1.8%	0.2%
Geological and Earth Sciences	4,778,000	64.5%	7.4%
Ocean Sciences and Marine Sciences	48,000	0.6%	0.1%
Other Geosciences, Atmospheric, and Ocean Sciences	2,449,000	33.1%	3.8%
Life Sciences	38,862,000	100.0%	60.3%
Agricultural Sciences	2,273,000	5.8%	3.5%
Biological and Biomedical Sciences	23,741,000	61.1%	36.8%
Health Sciences	5,180,000	13.3%	8.0%
Natural Resources and Conservation	6,508,000	16.7%	10.1%
Other Life Sciences	1,160,000	3.0%	1.8%
Mathematics and Statistics	0	0.0%	0.0%
Mathematics and Statistics	0	0.0%	0.0%
Physical Sciences	7,064,000	100.0%	11.0%
Astronomy and Astrophysics	4,687,000	66.4%	7.3%
Chemistry	799,000	11.3%	1.2%
Materials Science	478,000	6.8%	0.7%
Physics	941,000	13.3%	1.5%
Other Physical Sciences	159,000	2.3%	0.2%
Psychology	725,000	100.0%	1.1%
Psychology	725,000	100.0%	1.1%
Social Sciences	419,000	100.0%	0.7%
Anthropology	114,000	27.2%	0.2%
Economics	141,000	33.7%	0.2%
Political Science and Government	14,000	3.3%	0.0%
Sociology, Demography and Population Studies	55,000	13.1%	0.1%
Other Social Sciences	95,000	22.7%	0.1%
Other Sciences	403,000	100.0%	0.6%
Transdisciplinary, Multidisciplinary and Other Sciences	403,000	100.0%	0.6%
Non-Science and Engineering	1,908,000	100.0%	3.0%
Business Management and Business Administration	363,000	19.0%	0.6%
Communication and Communications Technologies	87,000	4.6%	0.1%
Education	1,171,000	61.4%	1.8%
Humanities	68,000	3.6%	0.1%
Law	0	0.0%	0.0%
Social Work	165,000	8.6%	0.3%
Visual and Performing Arts	54,000	2.8%	0.1%
Other Non-Science and Engineering	0	0.0%	0.0%

Exhibit NAU.TTA.1: Invention Disclosures Received and Enterprise Goals

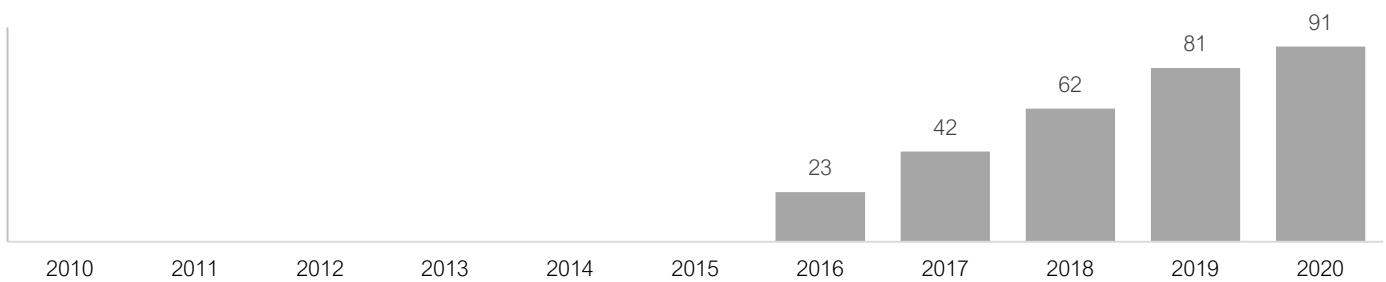
Invention Disclosures Received and Enterprise Goals



Actual to Enterprise Goal Differences



Cumulative Actual to Enterprise Goal Differences



Northern Arizona University

Exhibit NAU.TTA.2: Invention Disclosures

Invention Disclosures Received

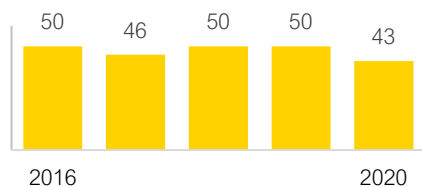
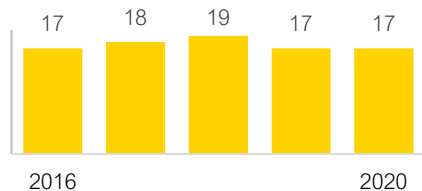


Exhibit NAU.TTA.3: Patents

New Patent Applications



US Patents Issued

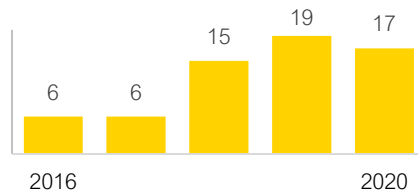
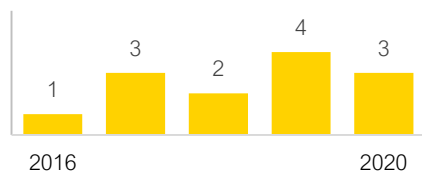
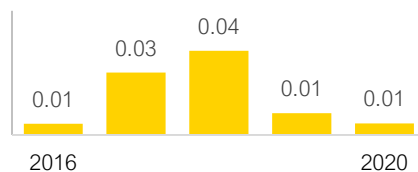


Exhibit NAU.TTA.4: Licenses and Options

Licenses and Options Executed



Licences and Options Income (in Millions)

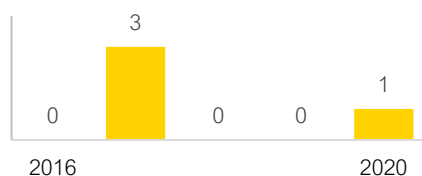


Intellectual Property Income	2016	2017	2018	2019	2020
Licenses and Options Income	5,286	30,070	40,549	10,500	5,561
Legal Fees Reimbursed	0	14,902	13,079	15,515	5,542
Other Revenue	3,236	0	40,548	0	20,000
Total	8,522	44,972	94,176	26,015	31,103

Royalty Distributions	2016	2017	2018	2019	2020
Inventors	-19,430	0	0	-2,619	0
Laboratories and Units	0	0	0	0	0
University	-26,287	0	0	0	0
Undistributed	0	30,070	0	0	0
Total	-26,287	30,070	0	0	0

Exhibit NAU.TTA.5: Startups

Startups



Cumulative Active Startups

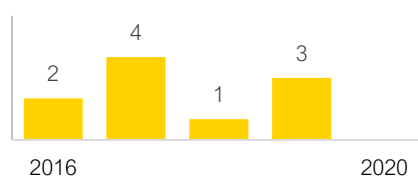
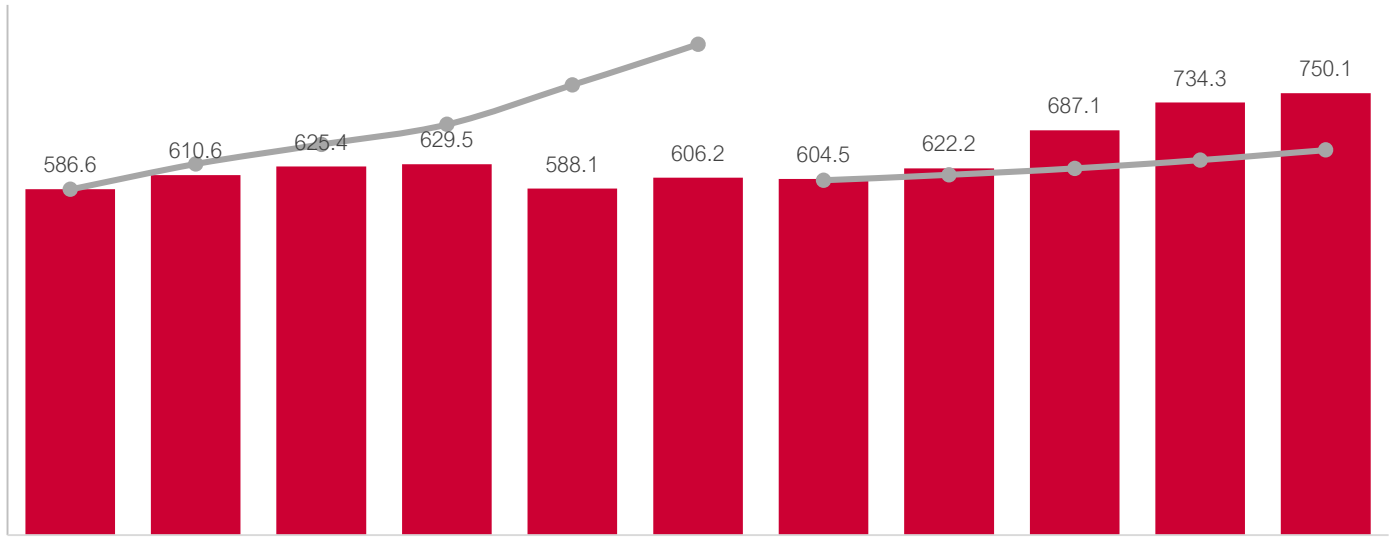
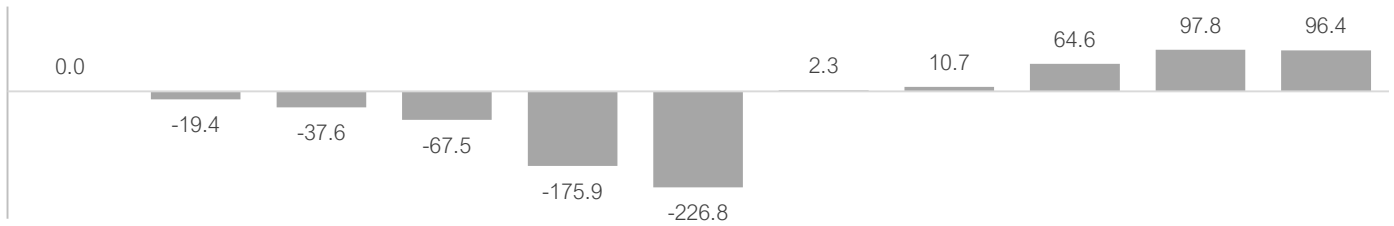


Exhibit UA.R.1: Research Expenditures and Enterprise Goals

Research Expenditures and Enterprise Goals in Millions



Actual to Enterprise Goal Differences in Millions



Cumulative Actual to Enterprise Goal Differences in Millions

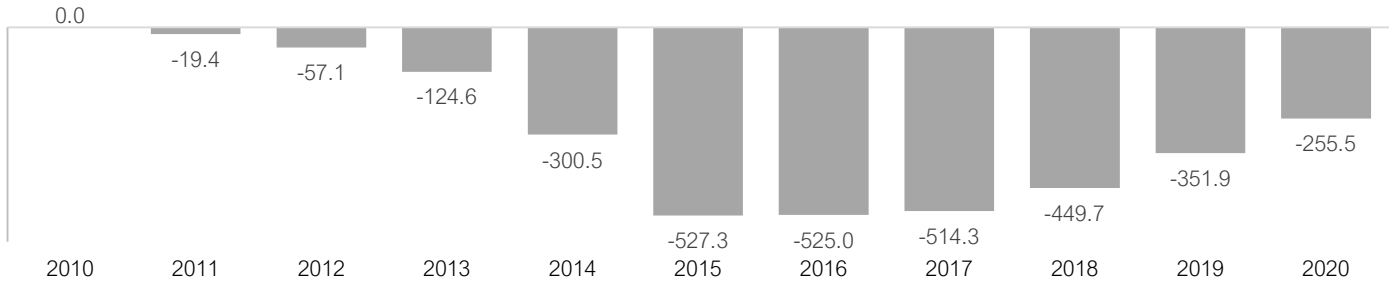


Exhibit UA.R.2: Other Sponsored Project Expenditures

Other Sponsored Project Expenditures in Millions

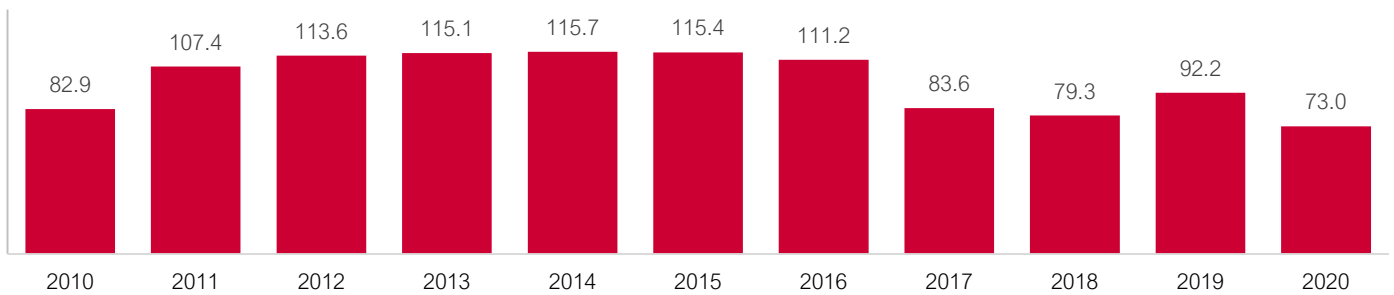


Exhibit UA.R.3: Research Expenditures National Comparisons

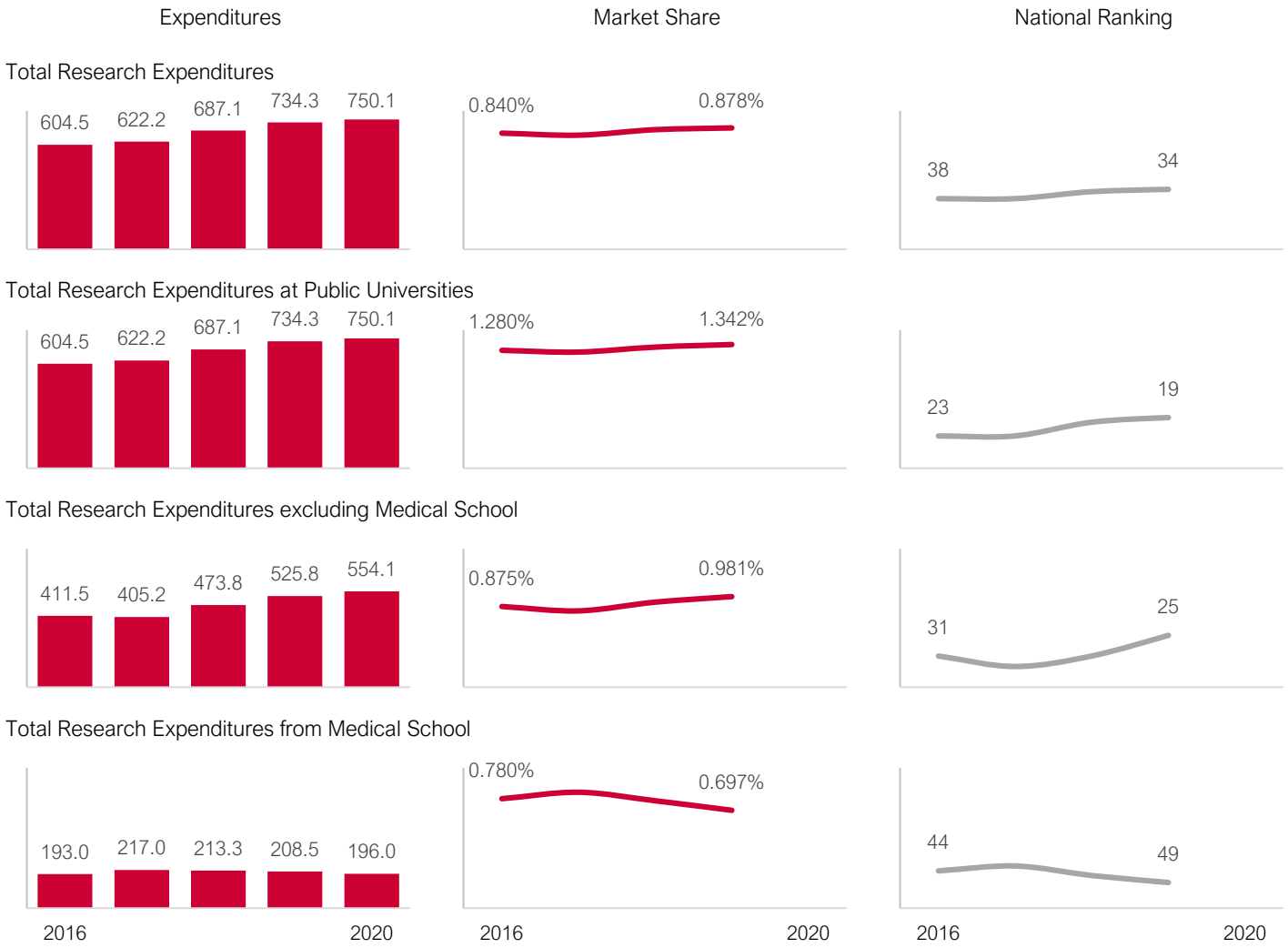


Exhibit UA.R.4: Research Personnel and Facilities

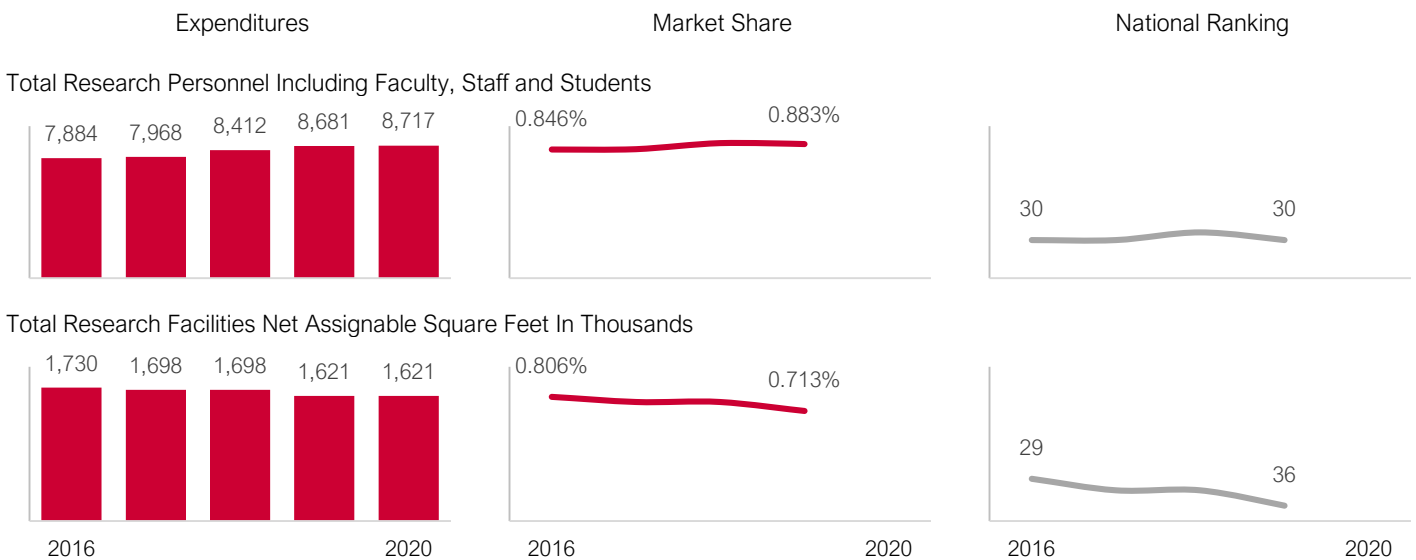


Exhibit UA.R.5: Research Expenditures by Sponsor Group

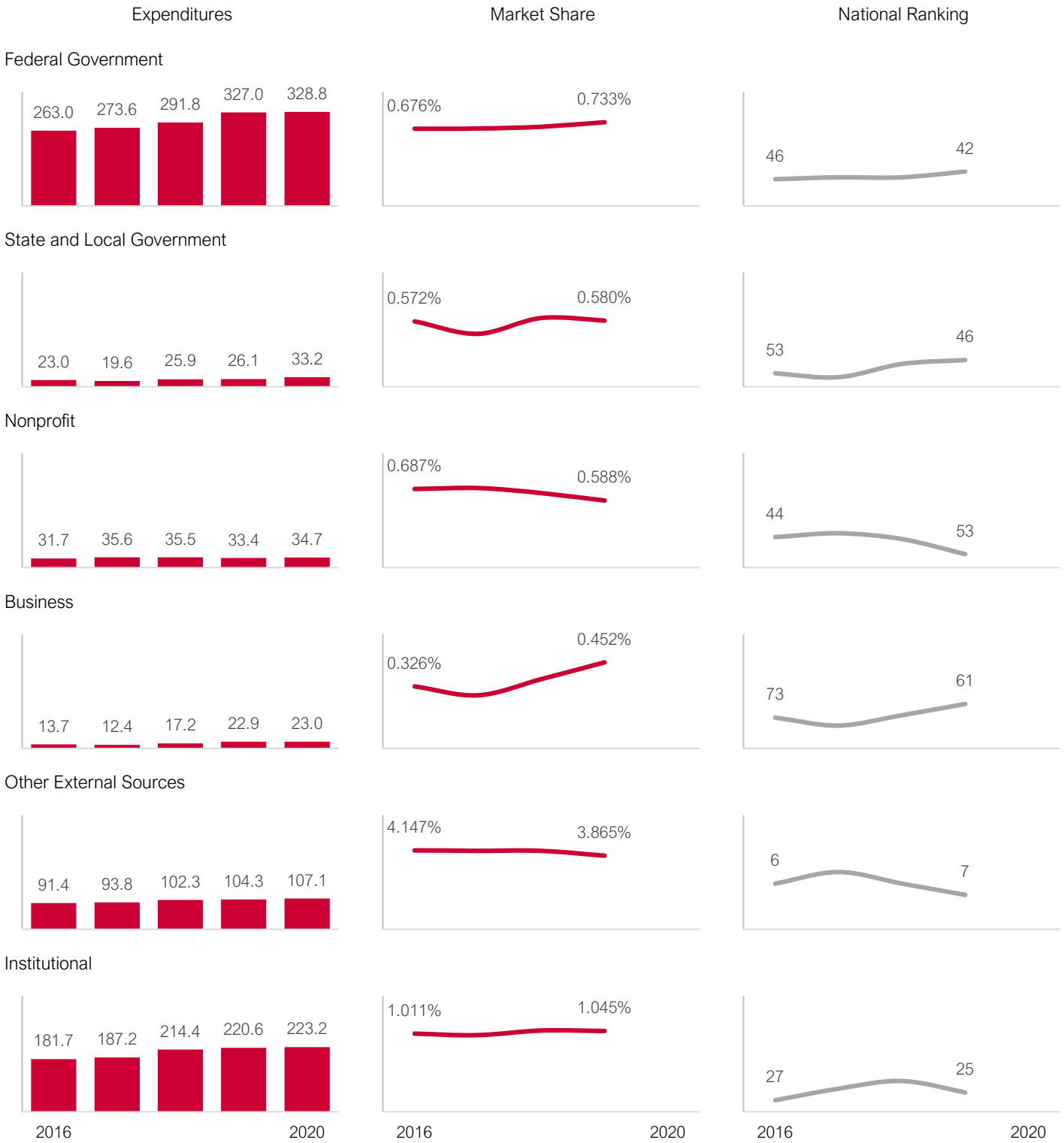


Exhibit UA.R.6: Federal Research Expenditures by Federal Agency

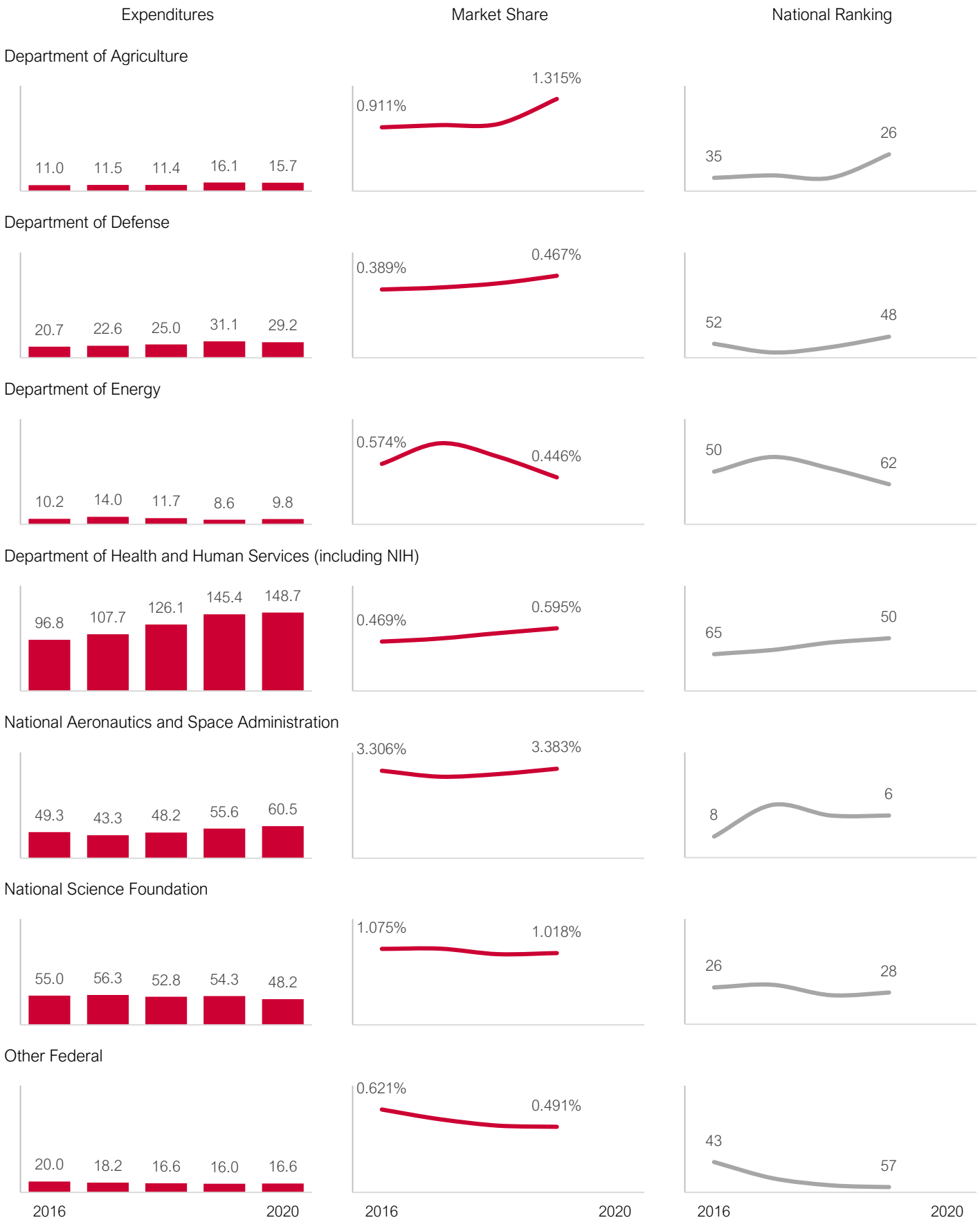
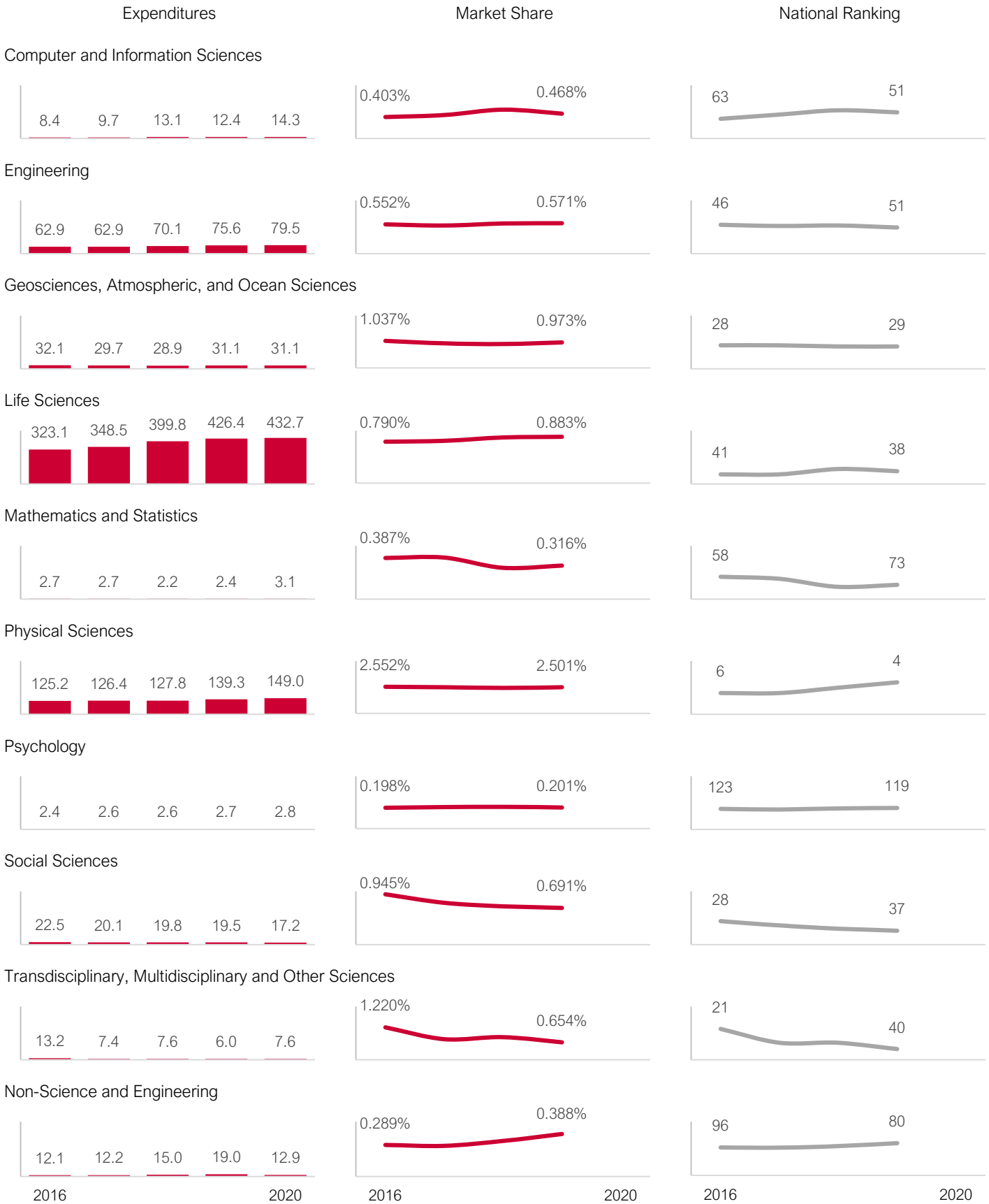


Exhibit UA.R.7: Total Research Expenditures by Broad Discipline



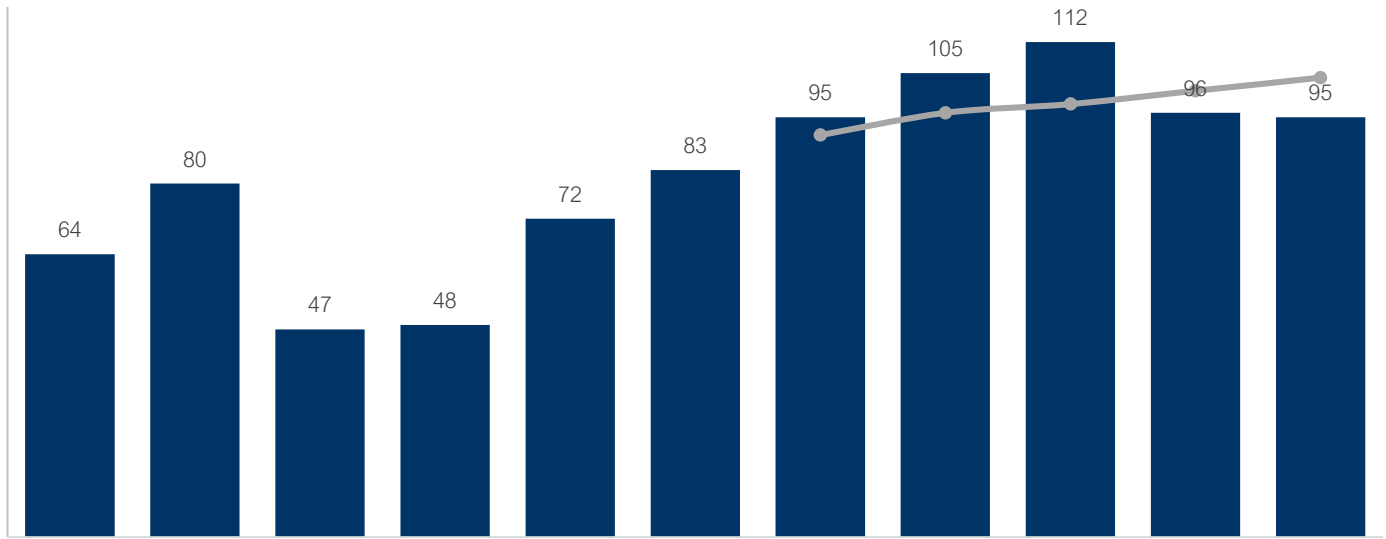
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Exhibit UA.R.8: Total Research Expenditures by Detailed Discipline

Research Discipline	2020 Expenditures	% of Discipline	% of Total
Computer and Information Sciences	14,259,000	100.0%	1.9%
Computer and Information Sciences	14,259,000	100.0%	1.9%
Engineering	79,463,000	100%	10.6%
Aerospace, Aeronautical and Astronautical Engineering	1,601,000	2.0%	0.2%
Bioengineering and Biomedical Engineering	8,552,000	10.8%	1.1%
Chemical Engineering	5,811,000	7.3%	0.8%
Civil Engineering	2,914,000	3.7%	0.4%
Electrical, Electronic and Communications Engineering	39,690,000	49.9%	5.3%
Industrial and Manufacturing Engineering	4,178,000	5.3%	0.6%
Mechanical Engineering	5,097,000	6.4%	0.7%
Metallurgical and Materials Engineering	7,902,000	9.9%	1.1%
Other Engineering	3,718,000	4.7%	0.5%
Geosciences, Atmospheric and Ocean Sciences	31,148,000	100.0%	4.2%
Atmospheric Science and Meteorology	5,223,000	16.8%	0.7%
Geological and Earth Sciences	22,911,000	73.6%	3.1%
Ocean Sciences and Marine Sciences	2,390,000	7.7%	0.3%
Other Geosciences, Atmospheric, and Ocean Sciences	624,000	2.0%	0.1%
Life Sciences	432,666,000	100.0%	57.7%
Agricultural Sciences	50,726,000	11.7%	6.8%
Biological and Biomedical Sciences	212,637,000	49.1%	28.3%
Health Sciences	156,165,000	36.1%	20.8%
Natural Resources and Conservation	13,135,000	3.0%	1.8%
Other Life Sciences	3,000	0.0%	0.0%
Mathematics and Statistics	3,098,000	100.0%	0.4%
Mathematics and Statistics	3,098,000	100.0%	0.4%
Physical Sciences	149,039,000	100.0%	19.9%
Astronomy and Astrophysics	121,809,000	81.7%	16.2%
Chemistry	14,511,000	9.7%	1.9%
Materials Science	3,434,000	2.3%	0.5%
Physics	9,230,000	6.2%	1.2%
Other Physical Sciences	55,000	0.0%	0.0%
Psychology	2,754,000	100.0%	0.4%
Psychology	2,754,000	100.0%	0.4%
Social Sciences	17,221,000	100.0%	2.3%
Anthropology	3,443,000	20.0%	0.5%
Economics	1,789,000	10.4%	0.2%
Political Science and Government	503,000	2.9%	0.1%
Sociology, Demography and Population Studies	3,904,000	22.7%	0.5%
Other Social Sciences	7,582,000	44.0%	1.0%
Other Sciences	7,566,000	100.0%	1.0%
Transdisciplinary, Multidisciplinary and Other Sciences	7,566,000	100.0%	1.0%
Non-Science and Engineering	12,856,000	100.0%	1.7%
Business Management and Business Administration	3,813,000	29.7%	0.5%
Communication and Communications Technologies	71,000	0.6%	0.0%
Education	2,823,000	22.0%	0.4%
Humanities	4,500,000	35.0%	0.6%
Law	373,000	2.9%	0.0%
Social Work	0	0.0%	0.0%
Visual and Performing Arts	140,000	1.1%	0.0%
Other Non-Science and Engineering	1,136,000	8.8%	0.2%

Exhibit UA.TTA.1: Licenses and Options Executed and Enterprise Goals

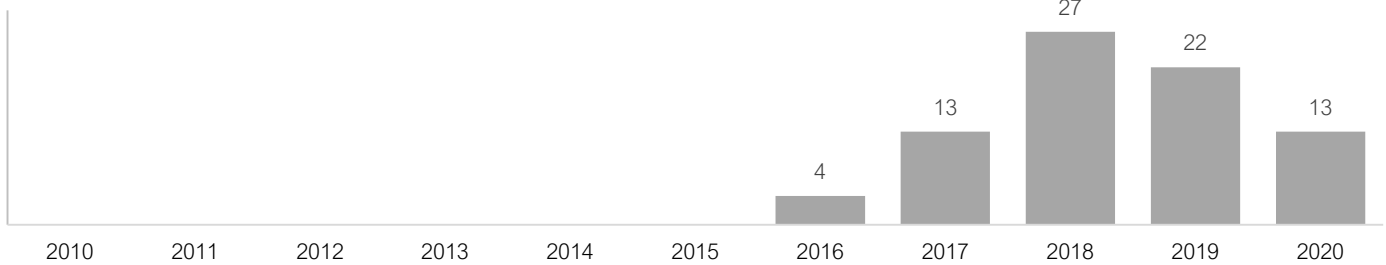
Licenses and Options Executed and Enterprise Goals



Actual to Enterprise Goal Differences



Cumulative Actual to Enterprise Goal Differences



University of Arizona

Exhibit UA.TTA.2: Invention Disclosures

Invention Disclosures Received

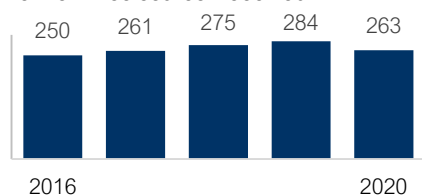
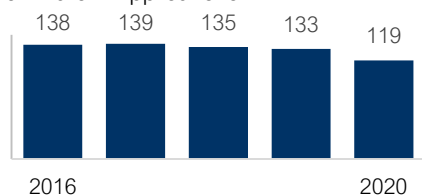


Exhibit UA.TTA.3: Patents

New Patent Applications



US Patents Issued

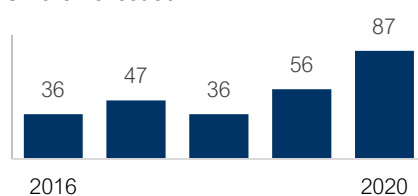
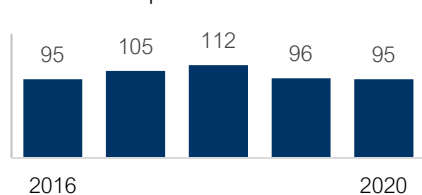
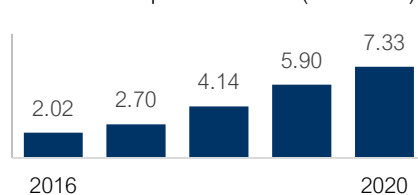


Exhibit UA.TTA.4: Licenses and Options

Licenses and Options Executed



Licences and Options Income (in Millions)

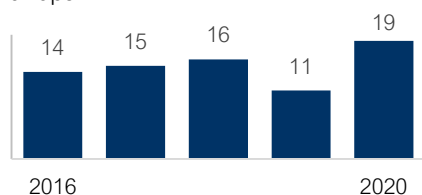


Intellectual Property Income	2016	2017	2018	2019	2020
Licenses and Options Income	2,015,807	2,703,261	4,141,604	5,901,957	7,333,122
Legal Fees Reimbursed	697,099	629,368	651,410	828,539	993,655
Other Revenue	0	0	0	0	0
Total	2,712,906	3,332,629	4,793,014	6,730,496	8,326,777

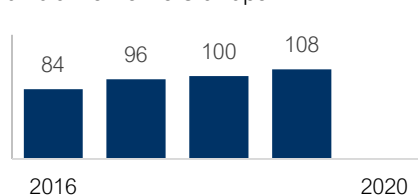
Royalty Distributions	2016	2017	2018	2019	2020
Inventors	-631,552	-946,141	-1,403,012	-1,904,368	-2,435,343
Laboratories and Units	-604,742	-865,044	-1,276,847	-1,708,098	-2,157,018
University	-507,454	-729,881	-1,383,993	-1,839,490	-2,365,761
Undistributed	272,058	150,000	77,751	450,000	375,000
Total	-840,138	-1,444,925	-2,583,089	-3,097,588	-4,147,779

Exhibit UA.TTA.5: Startups

Startups



Cumulative Active Startups





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