

**Research at New Mexico higher education institutions (HEI) generates significant revenue to support faculty and staff salaries and other institutional expenses and plays a critical role in academic achievement of students and economic development. Research on timely and important topics attracts attention, which in turn leads to greater institutional visibility and reputation. As a university becomes known for its research in certain fields, they become magnets for students, faculty, grants, media coverage, and even philanthropy. Strength in research helps to define a university's "brand" in the national and international marketplace, impacting everything from student recruitment, to attracting new investments. A strong research program can also provide institutions the resources to retain faculty and provide student learning opportunities at the undergraduate and graduate levels thus improving overall academic quality.**

Additionally, studies suggest that local economies are positively impacted by research spillover into the private sector, but this effect is dependent on how well the research of the institution is aligned with the existing economy. Policy makers recognized the importance of increasing funding for research activity and have made significant investments to boost research at New Mexico HEIs. Institutions in turn will be challenged to better align research and entrepreneurship to leverage new state funding and their existing relationships with national research laboratories, military installations and private industry to help create a dynamic economy with high-skill jobs to support New Mexico families.

## Research In New Mexico

New Mexico is home to three research institutions: the University of New Mexico, New Mexico State University, and New Mexico Tech. Data from the National Science Foundation (NSF) show research expenditures at these three institutions increased by 18 percent over the past decade, considerably less than national growth of 51 percent.

The NSF classifies research into three broad categories: basic research, applied research, and experimental development. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. Applied research is original investigation undertaken to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective. Experimental development is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

Research at all levels, from basic to experimental development, may be funded through grants or contracts. The Legislature has targeted appropriations to applied research and experimental development as there is a higher likelihood this research will have an economic development impact in addition to academic advancement.

**AGENCY:** University of New Mexico, New Mexico State University, New Mexico Tech

**DATE:** June 28, 2023

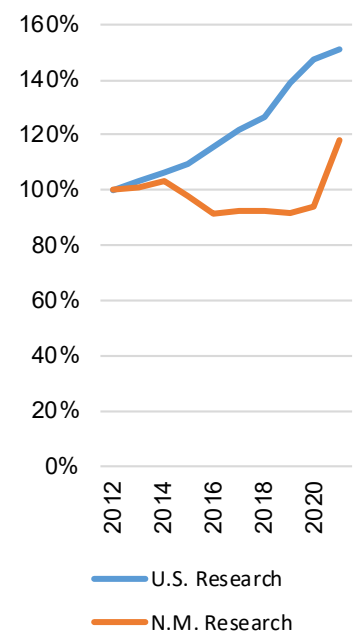
**PURPOSE OF HEARING:** Update on research and technology transfer

**WITNESS:**

**PREPARED BY:** Connor Jorgensen, LFC Analyst

**EXPECTED OUTCOME:** Informational

**Research Expenditure Growth, 2012-2021**



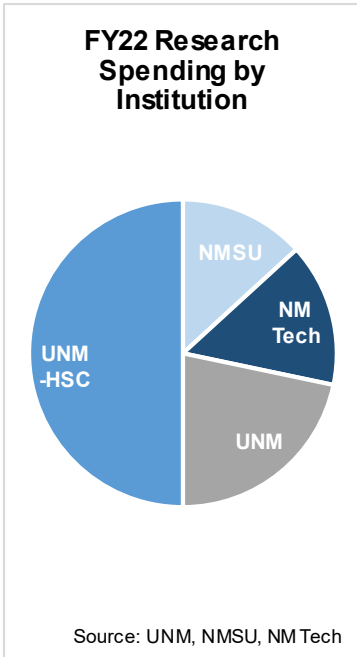
Source: NSF

The challenges and opportunities for research and development were laid out in a 2016 LFC evaluation of STEM degree production and employment outcomes. The evaluation found that while New Mexico had the highest number of Ph. D. scientists per capita, it also had the lowest growth in high tech jobs; that New Mexico HEIs were significantly underproducing STEM graduates, and that the state lagged the nation in terms of the amount of corporate-sponsored research activities.

The evaluation made several recommendations including that New Mexico institutions should consolidate and coordinate corporate relations under one office in order to attract additional corporate research funding. To date, no such office exists and institutions work independently and on an ad hoc basis with corporate partners. New Mexico institutions do not formally coordinate research priorities, but all three research institutions report an informal, ad hoc process for coordination. New Mexico HEIs should consider creation of research agendas that lay out for the Legislature, other institutions, and the public, general approaches to research opportunities and highlighting those areas that have state and regional implications- such as water treatment and purification.

### Research Spending

In FY22, research expenditures for the three research universities totaled \$596 million with the vast majority, \$505 million, coming from federal sources.



**FY22 Total Research Funding by Source**

Institution	State	Federal	Other	Total
NMSU	994,889	72,332,218	5,339,143	78,666,250
NM Tech	10,531,382	72,594,361	6,774,067	89,899,810
UNM	12,349,287	107,526,996	9,393,637	129,269,920
UNM-HSC	23,875,558	252,453,575	21,506,847	297,835,980
<b>Grand Total</b>	<b>47,751,115</b>	<b>504,907,151</b>	<b>43,013,695</b>	<b>595,671,961</b>

Source: NMSU, NMT, UNM

The majority of research funding awards are restricted to specific projects though there is often a portion that may be used for institutional support. This portion of grant and contract funding is referred to as indirect cost recovery or facilities and administration (F&A) rates. F&A rates differ by institution and award agreement. UNM’s published rates allocate 29 percent to 52.5 percent of federal awards to F&A while New Mexico Tech awards 19 percent to 31 percent for F&A. The F&A allocations are significant as they support overall institutional operations so that increases in research funding awards translate directly into increased funding that may be spent at the institution’s discretion.

A number of research grants require state matching funds which are often paid with state appropriations to instruction and general purposes (I&G) or with institutional funds. Analysis of the top 10 grants received by the three research institutions shows that eight of the 30 grants required a state match. These 30 awards accounted for \$545.8 million and required matching funds of \$67.7 million. The terms of the grants varied from 1 year to 16 years with an average duration of 5 years.

According to NSF data, New Mexico research institutions receive a higher proportion of research funding in the life sciences (including medical research) and engineering compared with the national average and a lower proportion in other disciplines including humanities.

**Proportion of FY21 Research Expenditures by Field of Study**

	Mathematics, computer and other sciences	Geo- and Physical Sciences	Life sciences	Psychology and Social Sciences	Engineering	Other/ Humanities
All Institutions	5%	10%	58%	5%	16%	6%
N.M. Institutions	5%	10%	62%	4%	18%	1%

Source: NSF

NSF data show that, after a period of stagnation, research expenditures increased in FY21 and actions at the federal level make this increase likely to turn into a longer term trend. The CHIPS act included spending authorizations of \$52 billion for semiconductor manufacturing and research as well as about \$170 billion for other research and development projects. In order to maximize available federal funding awards, New Mexico HEIs should collaborate to identify and apply for new grant awards.

**Technology Commercialization and Transfer.** New Mexico university research leads to innovations and invention that, while developed for a specific purpose, may have broader application. These technologies are often in the very early stages of development may, with additional investment of time and expertise, be brought to market. This process is referred to as technology transfer and all three research universities have programs and supports in place to facilitate it. The Rainforest and Bioscience Authority at UNM, the Arrowhead Center at NMSU, and the Office of Innovation Commercialization at New Mexico Tech all work with faculty and students on tech commercialization efforts.

Targeting growth in the high-tech sector is appealing as it requires little physical infrastructure and less need for corporate relocation as many tech jobs can be done remotely. However, Brookings Institution analysis finds that, even with the increase in remote work, the high-tech sector is highly concentrated in several major cities suggesting an advantage to workers clustered in a single location. The Brookings Institution analysis also found mixed results for the Albuquerque metro area with a slower-than-average growth rate over the 2015-2019 period and a higher growth rate for 2019-2020. The following table shows high-tech sector employment and growth rates for Albuquerque and other cities in the region.

**Tech Sector Employment by Metro Area**

Metro Area	Employment			2015-2019 Avg. Annual Growth Rate	2019-2020 Annual Growth Rate
	2015	2019	2020		
Albuquerque	6,795	7,526	7,887	2.6%	4.8%
Austin	67,107	83,175	86,027	5.5%	3.4%
Boulder	15,241	17,408	18,177	3.4%	4.4%
Denver	49,796	64,273	67,228	6.6%	4.6%
El Paso	3,334	2,614	2,760	-5.9%	5.6%
Lubbock	793	1,383	1,466	14.9%	6.0%
Phoenix	59,272	68,586	70,033	3.7%	2.1%
Provo	17,243	20,612	20,730	4.6%	0.6%
Salt Lake City	21,440	27,272	27,920	6.2%	2.4%
Tucson	6,201	6,521	6,748	1.3%	3.5%

Source: Brookings Institution

In order to build on recent growth, New Mexico will have to continue improving research and start-up conditions. As the Brookings Institution notes:

In many parts of the country, renewed state investments in public higher education (after a period of disinvestment) will be necessary in building up new tech hubs. In other regions, the way forward will likely involve complementing existing higher education strengths with coordinated state-level economic development strategies.

Leveraging technology research to drive economic development is a strategy being pursued by the state Economic Development Department (EDD). In 2020, EDD published its 20-year strategic plan. The plan focused on the department's previously identified nine key industries, including sustainable and green energy, aerospace and defense, sustainable and value-added agriculture, intelligent manufacturing, film and television, biosciences, global trade, outdoor recreation, and cybersecurity.

The Economic Development Department's strategic plan found:

*"stakeholders throughout the state noted a clear disconnect between the programs offered by New Mexico's higher education and training institutions and the needs of industry [as well as] misalignment between institutions and the state's economic development ambitions."*

EDD's strategic plan recognized the need for HEIs to work with private industry to create a robust workforce in the targeted sectors. However, the plan also found that "stakeholders throughout the state noted a clear disconnect between the programs offered by New Mexico's higher education and training institutions and the needs of industry [as well as] misalignment between institutions and the state's economic development ambitions." To bridge the gap between industry need and higher education offerings, the strategic plan provides recommendations including ensuring courses taught by in-state institutions are current and relevant.

While infrastructure including researchers, facilities, accelerators, and development centers exist, there is a lack of coordination among the various entities. Additionally, the number of entities with a stake in research and development is increasing; the Legislature provided \$50 million to the venture capital fund managed by the New Mexico Finance Authority for new business investment funds and the State Investment Council (SIC) to invest up to 11 percent of the severance tax permanent fund in New Mexico-based venture capital funds. There is also a proposal from CNM to begin a venture studio program to fund New Mexico start-up companies.

The state has invested significant new resources into both higher education and economic development as well as investment agencies to spur growth. In order to maximize the impact of these investments, all stakeholders must work to create a unified vision and priorities for these programs. Creation and close monitoring of performance measures, particularly focused on job creation, are needed. Stakeholders including HED, HEIs, EDD, NMFA, SIC, and others should work together to plan expenditure of new funding.

## Technology Enhancement Fund

The Legislature appropriated \$75 million to the technology enhancement fund (TEF) during the 2022 and 2023 legislative sessions. The technology enhancement fund was created "to provide matching funds to state research universities to support innovative applied research that advances knowledge and *creates new products and production processes* in the fields of agriculture, biotechnology, biomedicine, energy, materials science, microelectronics, water resources, aerospace, telecommunications, manufacturing science and similar research areas

(21-1-27.2 NMSA 1978).” The fund is designed to provide grants for collaborative research with corporate and nonprofit organizations.

Institutions apply for TEF funding by submitting research projects for review by the technology enhancement committee. Per rule, the committee is to be comprised of a panel of scientific and business experts established by the Higher Education Department (HED). The panel reviews all applications and makes funding recommendations to the HED secretary for final approval. The technology enhancement committee has had one meeting to date and awarded \$14 million of the \$75 million appropriated (See Appendix A). Future meetings are scheduled quarterly with the next meeting to be held in July, 2023.

Currently, there are eight members of the committee: one representative from each research university and Navajo Technical University, and one each from the technology transfer entities attached to the three research universities. The committee does not include representatives from industry or from the Economic Development Department. There is currently no timeline for the expenditure of the appropriated funding.

Statute requires TEF funds be used to “advance knowledge and create new products and production processes”. Awards for equipment purchases and studies could be made on the basis of advancing knowledge but have little or no potential for commercialization. Should the current broad selection criteria be used in subsequent award determinations, it is likely the funds may be expended more quickly, but the potential for economic development would be significantly diminished.

Higher education institutions need to articulate a vision for how future TEF funds can be used to enhance technology transfer and commercialization efforts as well as what the role of TEF in leveraging recent federal appropriations for research funds specifically through the Infrastructure and Jobs Act and the CHIPS Act.

A spending plan detailing potential annual awards from the TEF is required for the Legislature to assess the need for ongoing appropriations to the fund. After the first round of awards, the balance in the fund fell from \$75 million to \$61 million. However, the institutional capacity to expend the remaining funds is unknown. Additionally, there are currently no performance measures focusing on products or processes patented or licensed, companies founded, or jobs created.

**Technology Enhancement Fund Committee Members:**

1. UNM
2. UNM-Rainforest
3. UNM- Bioscience Authority
4. NMSU
5. NMSU-Arrow head
6. NM Tech
7. NMT- Tech Transfer
8. Navajo Technical University

**1<sup>st</sup> Round TEF Awards by Institution (in thousands)**

Inst.	Award	# Awards
UNM	\$6,487	13
NMSU	\$5,375	3
NMT	\$2,010	8
NTU	\$393	3
<b>Total</b>	<b>\$14,265</b>	<b>27</b>

Source: HEIs

Appendix A

Summary of Technology Enhancement Fund Awards, Round 1

Inst.	Application	Funding Agency	Amount of Grant Award, Excluding Match	Total Technology Enhancement Fund Award	Match Rate	New Project (Yes/No)	Commercialization potential (Yes/No)	TEF qualification
NM Tech	2022-2024 NM STATEMAP - Geological Studies in New Mexico	U.S. Geological Survey- Department of Interior	\$ 668,850	\$ 766,072	115%	No	Yes	Advances knowledge
NM Tech	Equipment: Raman Microscope	NSF-MRI	\$ 226,819	\$ 170,115	75%	No	Yes	Advances knowledge
NM Tech	NM Water Data Initiative: Improving water data access for modeling in the middle Rio Grande. this proposal in response to the BOR's Funding Opportunity No. R21AS00289 – WaterSMART	Bureau of Reclamation	\$ 195,050	\$ 196,660	101%	No	Yes	Advances knowledge
NM Tech	Additive manufacturing for space applications	NASA EPSCoR	\$ 150,000	\$ 112,500	75%	No	Yes	creates new products and production processes
NM Tech	Hydrophilic-omniphobic HF membrane-based DCMD and crystallization for zero liquid discharge of oilfield produced water	Department of the Interior, Bureau of Reclamation	\$ 249,587	\$ 113,550	45%	No	Yes	creates new products and production processes
NM Tech	AFRL Southwest Regional Partnership Intermediary Agreement	DOD/U.S. Air Force/Air Force Research Laboratory	\$ 39,688,873	\$ 296,637	1%	No	Yes	creates new products and production processes
NM Tech	CarbonSAFE Phase III	Department of Energy	\$ 17,471,541	\$ 230,907	1%	No	Yes	creates new products and production processes
NM Tech	CORE-CM Assessment	Department of Energy	\$ 1,556,480	\$ 123,094	8%	No	Yes	creates new products and production processes
<b>NM Tech Total</b>			<b>\$ 60,207,200</b>	<b>\$ 2,009,535</b>	<b>3%</b>			
NMSU	Equipment: Analytical Instrumentation Suite for Research in Energy, Agriculture, Water, and Materials Science.	Shimadzu Corp., NM INBRE, NMSU	\$ 1,355,063	\$ 1,961,418	145%	Yes	Yes	creates new products and production processes
NMSU	Instrumentation. Chemistry and Biochemistry Molecular Structure Determination Core	NIH	\$ 18,508,435	\$ 651,315	4%	Yes	Yes	creates new products and production processes
NMSU	Instrumentation. Technology Enhancement for a Biomedical Research Facility at an HSI on the US-Mexico Border.	NIH C06	\$ 7,084,640	\$ 2,762,300	39%	No	Yes	creates new products and production processes
<b>NMSU Total</b>			<b>\$ 26,948,138</b>	<b>\$ 5,375,033</b>	<b>20%</b>			
UNM	Integrative Treatment for Achieving Holistic Recovery from Comorbid Chronic Pain and Opioid Use Disorder. This project will develop and test new interventions.	NIH	\$ 7,726,832	\$ 1,250,000	16%	Yes	Yes	advance knowledge
UNM	Hire 9 new faculty positions. UNM First: Promoting Inclusive Excellence in Neuroscience and Data Science.	NIH	\$ 15,463,148	\$ 2,000,000	13%	Yes	No	advance knowledge
UNM	Equipment: MRI: Acquisition of an X-Ray Micro-Computed Tomography Scanner for Specimen-Based and Material Science Research.	NSF	\$ 464,895	\$ 187,276	40%	Yes	No	advance knowledge
UNM	Wildlife Habitat Analysis for Conservation.	USDA Forest Service	\$ 1,013,767	\$ 164,114	16%	Yes	No	create new process

Appendix A

Inst.	Application	Funding Agency	Amount of Grant Award, Excluding Match	Total Technology Enhancement Fund Award	Match Rate	New Project (Yes/No)	Commercialization potential (Yes/No)	TEF qualification
UNM	Product development for solid-state mixed-potential electrochemical sensors for natural gas leak detection and quality control.	DOE, UNM, SCT	\$ 500,000	\$ 99,105	20%	No	Yes	create new process
UNM	Entrepreneurship development program at UNM Taos.	EDA	\$ 747,324	\$ 314,908	42%	Yes	No	advance knowledge
UNM	Training program for K-12 STEM teachers.	NSF	\$ 918,200	\$ 447,027	49%	Yes	No	advance knowledge
<b>UNM Total</b>			<b>\$ 26,834,166</b>	<b>\$ 4,462,430</b>	<b>17%</b>			
UNM-HSC	Study access to kidney transplantation in minority populations.	NIH	\$ 2,864,020	\$ 375,000	13%	No	No	advance knowledge
UNM-HSC	Equipment: State-of-art cell sorting instrument for biomedical research.	NIH/NCI	\$ 4,118,800	\$ 400,000	10%	No	No	advance knowledge
UNM-HSC	Thinking Zinc: A Study of Zinc Supplementation to counteract toxicity associated with exposure to environmental metal toxicants	National Institute of Environmental Health Sciences	\$ 1,399,204	\$ 500,000	36%	No	No	advance knowledge
UNM-HSC	Increase training and distance coaching of highly specialized teaching strategies for children with deafblindnes.	Office of Special Education Programs	\$ 589,850	\$ 100,000	17%	No	No	advance knowledge
UNM-HSC	Build career pathways for underrepresented minority students in 2- and 4- years programs with a focus on research; currently UNM has funds for the center but TEF supports developmnet of this program.	NIH/NCATS UNM HSC Clinical and Translational Science Center	\$ 4,118,800	\$ 400,000	10%	No	No	advance knowledge
UNM-HSC	Telequity: To access to and use of broadband and devices for healthcare and education by families with school-aged children	Health Resources and Services Administration	\$ 473,000	\$ 250,000	53%	No	No	advance knowledge
<b>UNM-HSC Total</b>			<b>\$ 13,563,674</b>	<b>\$ 2,025,000</b>	<b>15%</b>			
<b>Grand Total</b>			<b>\$ 127,553,178</b>	<b>\$ 13,871,998</b>	<b>11%</b>			

According to statute, TEF funding should be used for projects that advance knowledge or create new products or production processes. This appendix includes information for state research universities but does not include information from NTU.