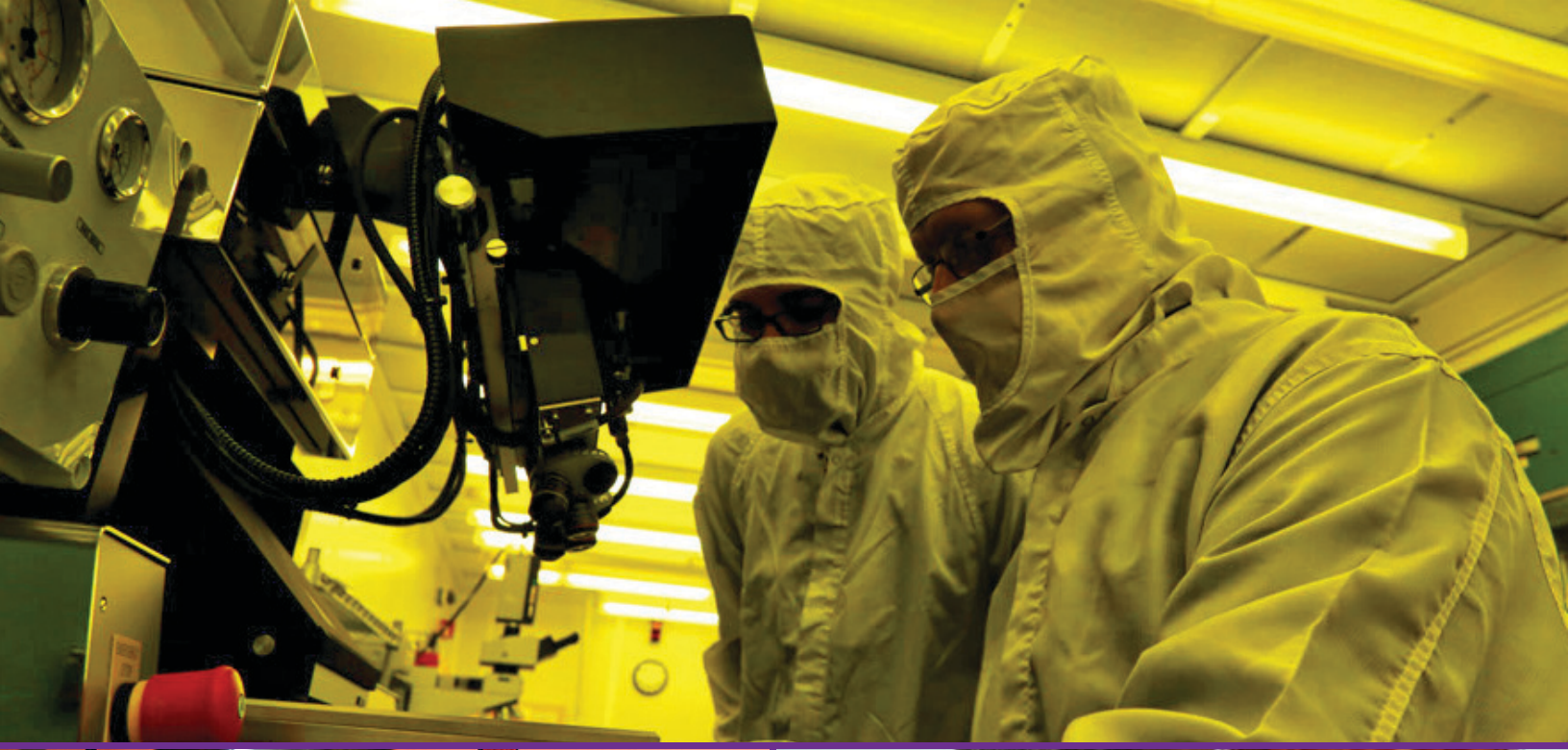
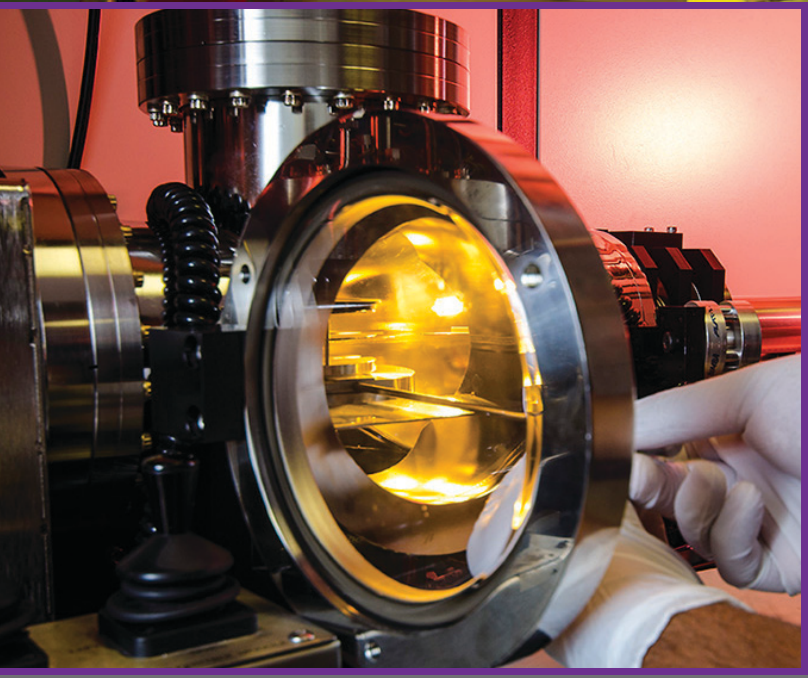




Innovate! New Mexico

New Mexico Science and Technology Plan

November 2015

NEW MEXICO
ECONOMIC DEVELOPMENT DEPARTMENT

SUSANA MARTINEZ
GOVERNOR

JON BARELA
CABINET SECRETARY

NEW MEXICO ECONOMIC DEVELOPMENT DEPARTMENT

We want to thank all those who participated in the collaborative effort to produce *Innovate! New Mexico: The 2015 Science and Technology Plan*. We recognize the importance of recommendations provided by industry leaders who have been the pioneers in developing ideas and building companies to benefit the state's economy. And, we owe much to those at our research institutions who work as partners to industry to keep the innovation fires burning. Their participation in the process focused on how best to convert the extensive research capital invested in our state towards the growth of a technology-based, diverse economy.

Innovate! New Mexico emphasizes the state's technological strengths and our commercial advantages. It is aligned with the State 5-Year Strategic Plan and with the Technology Research Collaborative's plans to help businesses make the rapid transfer of new ideas and new technology from the lab to the marketplace.

The plan is focused on four industry sectors, water, energy, biosciences and photonics, because they are cross-cutting industries where significant resources already are in play. When these industries succeed, they are foundational to helping other industries prosper.

We applaud the plan's three strategic priorities: 1) To grow and diversify existing technology companies to ensure their global competitiveness, 2) Enable the creation of commercial enterprises from technologies invented in New Mexico, and 3) Strengthen the position of New Mexico universities and companies in partnership with national laboratories to develop robust capabilities in emerging research and development.

Governor Martinez and I have emphasized the importance of investing in converting our state's research capability into economic prosperity and diversifying the economy that has for too long been reliant on federal dollars. As part of that platform the Governor succeeded in securing funds to recruit top researchers to our research universities and for the Technology Research Collaborative, as well as working with the legislature to provide an improved tax and business climate for all private companies.

We look forward to being presented policy opportunities and more great ideas as more initiatives unfold as a result of the work that will be done to affect this plan.

Jon Barela
Cabinet Secretary

Joseph M. Montoya Bldg. 1100 St. Francis Dr. Santa Fe, New Mexico 87505-4147
(800) 374-3061 (505) 827-0307 fax: (505) 827-0263 goNM.biz

CONTENTS

EXECUTIVE SUMMARY **1**

INTRODUCTION **2**

OFFICE OF SCIENCE AND TECHNOLOGY 2

Technology Research Collaborative *2*

Defense Industry Diversification *2*

PLAN FOUNDATION AND APPROACH **3**

TECHNOLOGY FOCUS AREAS **3**

WATER 4

ENERGY 5

BIOSCIENCE 6

PHOTONICS 7

THE INNOVATION AND ENTREPRENEURIAL ECOSYSTEM **8**

STRATEGIC PRIORITIES AND GOALS **11**

STRATEGIC PRIORITY #1: Grow and Diversify Existing Technology Companies *13*

STRATEGIC PRIORITY #2: Commercialize Technologies and Innovations *15*

STRATEGIC PRIORITY #3: Increase Research and Development Capacity *17*

CONCLUSION **19**

APPENDIX A. PLAN FOUNDATION **20**

"INNOVATION CREATES DIVERSIFICATION—NMEDD 5-YEAR PLAN FOR STRATEGIC ECONOMIC GROWTH & DIVERSIFICATION 2013–2018" 20

FOCUS GROUPS 20

TECHNOLOGY RESEARCH CENTERS STUDY 21

NEW MEXICO'S COMPETITIVE BUSINESS TAX CLIMATE 21

MILKEN'S 2014 "STATE TECHNOLOGY AND SCIENCE INDEX" 22

ACKNOWLEDGMENTS **24**

BIBLIOGRAPHY **27**

THIS PAGE INTENTIONALLY BLANK

EXECUTIVE SUMMARY

Given New Mexico's reliance on declining federal spending and tax revenues from the fluctuating oil and gas industry, the need to create a robust and diverse innovation- or technology-based private sector economy is crucial. Whether it is to enhance existing industries or create entirely new industries, the drive for discovering and delivering new ways to improve all business sectors is so crucial that it has been termed the "*Innovation Imperative*" (Marino 1). Innovate! New Mexico, the New Mexico Science and Technology Plan, recommends realistic, achievable near-term actions to jump-start technology business growth and making New Mexico a place in which innovators and entrepreneurs can thrive.

The plan framework is designed around three strategic priorities: grow and diversify existing technology businesses, rapidly commercialize innovations and technologies, and advance our capacity in emerging research fronts. We will launch a statewide program for defense industry diversification, facilitate the commercialization of university and laboratory innovations into new and existing companies, and engage in research and development collaborations that build and diversify the state's current strengths while generating new capabilities. Particular objectives include strengthening the key industries that currently support our state; leveraging the state's rich capabilities from decades of national security funding; and developing the state's water, energy, bioscience and photonics sectors.

The strategies and goals in this plan are based on insights gleaned from recent national studies, feedback from focus groups, and our intent to exploit recent improvements in the state's business tax climate. Focus groups universally identified tax structures and a void of seed and growth capital as conditions forcing innovators and entrepreneurs to leave New Mexico to grow their businesses. Milken Institute's "State Technology and Science Index, 2014" asserts that competition has increased among all states for high technology jobs and innovation, and that states must make intentional investments to be top performers. The index also shows that New Mexico's rankings have declined overall between 2012 and 2014, mostly in the category of Technology Concentration & Dynamism, indicating that New Mexico has not been effective at strengthening and growing our tech-based economy, particularly relative to other states.

Creating a more competitive business tax environment in New Mexico is key to assuring that the investments to convert innovations to new businesses would actually result in retaining those businesses. Little sustaining benefit to the state would result from converting innovations to business, if those businesses were to leave the state to grow. New Mexico is now well-positioned to make the most of investments in the conversion of innovations to new businesses and economic prosperity.

New Mexico has recently garnered citations for competitive tax structure. In June 2015, New Mexico made a sizeable jump on CNBC's 2015 "America's Top States for Business" scorecard, jumping from 37th to 24th place in the nation. In January 2014, Governor Susanna Martinez was one of six governors recognized by the nonpartisan Tax Foundation for Outstanding Achievement in State Tax Reform; and Ernst & Young's study on tax competitiveness shows that New Mexico has the best tax climate for manufacturers in the nine-state western region. In August 2014, Kiplinger named New Mexico the 8th Most Tax Friendly State, up from 9th in 2013.

While we envision a holistic program for New Mexico that builds our innovation and entrepreneurial capacity, we acknowledge that full implementation may be lengthy. New Mexico's innovation and technology base can only grow with commitment and continuous, consistent investment. Such investments, when made responsibly, produce true, sustainable results leading to economic prosperity. We will focus on filling key gaps, vigorously pursuing near-term wins, and increasing program elements over time, to position the state for enduring growth and success.

INTRODUCTION

OFFICE OF SCIENCE AND TECHNOLOGY

Mission: Lead and execute programs to encourage and enable the start-up, growth and relocation of technology-based industries.

Vision: New Mexico's robust ecosystem, with ample capital and global business management expertise, enables our research and innovations to move rapidly into the hands of experienced, successful entrepreneurs and on to a global market. A friendly business tax climate, inviting culture of innovation and a vibrant, collaborative statewide innovation community makes New Mexico a top choice for local and international entrepreneurs, Science, Technology, Engineering and Math (STEM) graduates, and knowledge workers to live, work and invest.

The NMEDD's Office of Science and Technology (OST) reopened late July 2014. While this office is currently staffed with one full-time employee, an increase in staff and resources proportional to the growth of these activities is planned.

Currently the NM EDD OST is focused on three major activities:

1. Launch the **Innovate! New Mexico** Initiative
2. Implement a **Defense Industry Diversification** Program
3. Facilitate the operations of the **Technology Research Collaborative**

Technology Research Collaborative

The Technology Research Collaborative (TRC) was created by statute to develop and commercialize innovative technologies resulting from collaborations among New Mexico's research universities and the three federal laboratories located in New Mexico. According to the legislation, the TRC consists of the presidents or their designees of the University of New Mexico (UNM), New Mexico State University (NMSU) and New Mexico Institute of Mining and Technology (NMT); the directors or their designees of Sandia National Laboratories (SNL), Los Alamos National Laboratory (LANL), and the Air Force Research Laboratory (AFRL); and five private sector appointees.

The purpose of the TRC, as legislated in House Bill 562, is to: (1) establish advanced technology centers based on the wealth of scientific and technical talent that exists in the member institutions; (2) develop and create new intellectual property for the state, encourage new opportunities for business and increase jobs; (3) commercialize the intellectual property that is created; and (4) create a work force to support enterprises based on the intellectual property that is created.

Defense Industry Diversification

The Office of Economic Adjustment (OEA) is the Department of Defense (DOD) field organization responsible for supporting state and local governments in responding to major defense program changes. Since 1961, OEA has helped communities in the United States develop comprehensive strategies to adjust to defense spending cutbacks, base closures or expansions, and incompatibilities between military operations and local development.

NMEDD/OST received initial grant funding from OEA in June 2015 to implement a Defense Industry Diversification program. During the first phase of this program, we will perform an assessment and analysis of the state's defense industry ecosystem, as well as the assets and industry clusters to support the development of diversification strategies. We will also conduct a pilot project for innovation commercialization methodologies as a diversification approach that can be implemented statewide.

PLAN FOUNDATION and APPROACH

The drive to enable, support and invest in innovators and entrepreneurs informs the recommendations made in this plan. The framework of the plan is designed around the continuum from research and development to scalable products and manufacturing, and is shown in Figure 2. The Strategic Priorities are designed to maximize the favorable improvements in the state's business tax climate, and leverage federal research and development investments.

Appendix A details the extensive research and planning that went into developing this plan, including key takeaways from the NMEDD 5-Year Plan "Innovation Created Diversification", focus groups convened by NMEDD, a Technology Research Center Study sponsored by the Technology Research Collaborative (TRC), and the Milken Institute's 2014 "State Technology and Science Index", and business tax incentives.

Tax deductions such as the Consumables Gross Receipts Tax Deduction and Single Sales Factor for Manufacturers have already attracted technology manufacturers to the state. The newest 2015 tax package is highly beneficial for technology-led economic development, and includes a corporate headquarters tax exemption, an expansion of the Angel Investment Tax Credit, a gross receipts deduction for directed energy and satellite research and production, and amends the technology jobs tax credit to create the Technology Jobs and Research and Development Tax Credit Act. We are working on improving the state's rankings, but more importantly, realizing significant growth in knowledge-based jobs in all technology sectors across the state.

TECHNOLOGY FOCUS AREAS

With the Innovate! New Mexico program, NMEDD/OST's objective is to enable delivery of innovations and growth of private sector enterprises, that:

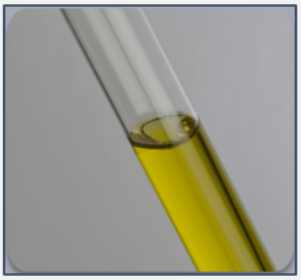
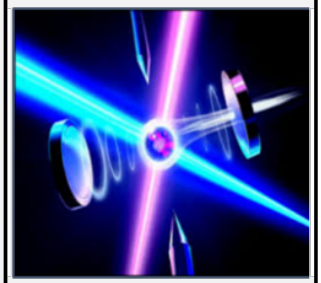
- Strengthen and increase competitiveness of our **existing key industries**,
- Leverage our legacy capabilities and technical strength in **national security and defense**, and
- Accelerate the strategic development of four sectors: **Water, Energy, Bioscience & Photonics.**

Key Industries. NMEDD's website, www.gonm.biz points to "key industries" that drive New Mexico's economy today. They are: energy and natural resources; aerospace and defense; value-added agriculture; distribution, logistics and transportation; advanced manufacturing; digital and emerging media; and back office and technical support.

National Security and Defense. Because of decades of national security and defense research and development investments at federal laboratories and military bases in New Mexico, our universities, industries and workforce have strong capabilities in areas such as advanced computing, cyber security, modeling and simulation, nuclear science, remote sensing, space, optics and photonics, directed energy, robotics and unmanned and autonomous systems. As we continue to pursue opportunities for growth in the defense and national security sector, we must explore how these capabilities create new business opportunities when applied to non-defense markets. For example, our existing capabilities in advanced sensors and detectors, combined with legacy capabilities in agriculture and food production can forge new opportunities in the emerging area of "food security", addressing bio threats in food and agriculture. Another example, integrating advanced image recognition and data analysis used in national security applications has the potential for commercial image analysis products that help governments and companies understand global environmental and agricultural trends and threats.

Water, Energy, Bioscience, and Photonics. A focus on Water, Energy, Bioscience and Photonics leverages our existing, inherent assets and advantages, and addresses issues critical to the state (water, energy and medicine/health care), while benefiting from commercial growth globally of photonics and bioscience industries. There are also extremely strong prospects for interdisciplinary development and collaboration among these sectors to further hone a competitive market position, such as the nexus of photonics and biomedical technologies or the water, energy, and water/energy/food nexus.

We envision a future in which New Mexico exists as a global showcase and magnet for water, energy, bioscience, and photonics related industries.

Water	Energy	Bioscience	Photonics
			
• Sustainability and self-sufficiency serves business and residential population with water • Leverage commercial opportunities in a way that efficiently grows the industry • Globally respected for water technology	• Serves as an energy showcase and magnet to attract companies and experts • Supports balanced portfolio to insulate against price volatility and leverages diverse energy sources, state geography, and value chain • Leads energy innovation and education	• Critical mass of bioscience companies and jobs • Wealth creation—continuous 'system' • Pipeline of new research entities and ideas • Growth of bioscience companies to commercial viability • Strong bioscience talent pool	• Closely networked community facilitating operations, recruitment and business opportunities • Leveraged Intellectual Property portfolio-creating and -exporting products • Branded internationally in research, workforce and industry

Water

The availability of usable water is not only a global concern, it also presents a critical constraint to the vitality of New Mexico's economy. A statewide solution to the current drought, the prolonged arid cycle, and a sustainable water future will necessitate the application of promising research and technology in myriad ways. Some of those include new conservation approaches, mitigation and reduction of evaporation and water loss, and the development of abundant, non-traditional water resources such as saline or brackish aquifers and oil- and gas-produced water.

New Mexico is wealthy in terms of its research institutions and unique facilities that focus on water issues, such as the *New Mexico Water Resources Research Institute* and the only U.S. Bureau of Reclamation Brackish Groundwater Desalination Research Facility in the country. New Mexico Institute of Mining and Technology houses the geological survey and hydrogeology data for the State of New Mexico (New Mexico Bureau of Geology and Natural Resources). New Mexico has an abundance of unique natural resources, a strong energy industry, and an increase in small companies specializing in water purification and treatment—all of which can synergistically contribute to viable water solutions. Central to creation of a sustainable water future in New Mexico is the identification of obstacles and a commitment to their resolution in terms of infrastructure, regulatory and policy concerns, and technology commercialization.

If we are successful in our water-related endeavors, we could expect to see a water future that sustainably and self-sufficiently serves business, agriculture, and residential populations with water. By leveraging commercial opportunities in a way that efficiently grows the industry, New Mexico could one day become globally respected for its water technology development and deployment.

Energy

Energy has played a large role in driving New Mexico's economy for nearly 50 years. New Mexico's extractive and renewable energy sources are diverse and have the potential for greater energy production. On a national scale, the state is 10th for total energy production and the 4th largest net energy supplier (2012, 2014 Energy Information Administration (EIA) 13). New Mexico has immense, largely untapped energy reserves in the form of sunshine and wind, oil and natural gas reserves, extensive low-temperature geothermal energy sources, proven uranium deposits, and large brackish water aquifers with high total dissolved solids (e.g., supporting osmotic power development). With careful planning and a willingness to invest in developing New Mexico's energy resources, New Mexico can begin to harness its abundant renewable energy resources and sustainably capitalize on other resources such as geothermal and uranium reserves while maintaining strong environmental protections.

New Mexico's Permian Basin, which contains three of the 100 largest oil fields in the United States, is estimated to contain over 70% of available oil resources in the country (2012–2014, EIA). The San Juan Basin contains one of the largest proven natural gas reserves in the country, and the state accounts for about 5% of national output (2014, EIA).

With over 300 days of sunshine each year, New Mexico's solar capacity is substantial. Today the state is 5th in the nation for utility-scale electricity generation from solar energy (2013, EIA) and 4th for installed photovoltaic capacity, with even more installations in the pipeline. Wind farms continue to populate the eastern region of the state, contributing more than 6% to New Mexico's electricity generation. Geothermal potential is strong in New Mexico and we are only one of 13 states with geothermal projects underway. Our low-temperature geothermal resources are used for spa resorts, fishery and greenhouse projects, and more applications are being researched.

Significant energy research capacity exists within New Mexico through the work of two U.S. Department of Energy laboratories—Sandia National Laboratories and Los Alamos National Laboratories but also at our university research, particularly through the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR) program. EPSCoR's emphasis is research on improving energy extraction efficiencies and promoting sustainable energy resource development. New Mexico Tech (NMT) operates the nationally recognized Petroleum Recovery and Research Center (PRRC). PRRC has been the research arm of the oil and natural gas industry in New Mexico since its establishment as a research division of NMT by the New Mexico State Legislature in 1977. Sandia and Los Alamos are part of a vast science, technology and innovation complex with research and development capacity in energy sources, energy efficiency, electrical power, and energy security. Additionally, the state is located at the juncture of three national electricity grids, which position it to tap into multiple electricity markets and offer affordable energy and reliable electrical power. New Mexico can be well served in the energy sector by removing regulatory and investment barriers, further expanding market opportunities, and encouraging investment from a variety of sources—from infrastructure improvements to technology commercialization.

Water/Energy Nexus

Our recognition of the interconnectedness of energy and water challenges is expected to stimulate the development of solutions that address objectives in both domains, and can simultaneously position New Mexico to be a leader in this area. Water and energy are inherently linked, in that it typically requires water to produce energy and it takes energy to treat and distribute water for use. Focusing on those challenges will be vital, as water is necessary for economic prosperity and energy sources are abundant in the state. Further, an increasing population and changes in precipitation and temperature patterns in the Southwest region can greatly affect water availability and impose a strain on energy production.

In 2012, DOE identified six strategic pillars to address the Water/Energy Nexus, as follows:

1. Optimize the freshwater efficiency of energy production, electricity generation, and end-use systems.
2. Optimize the energy efficiency of water management, treatment, distribution, and end-use systems.
3. Enhance the reliability and resilience of energy and water systems.
4. Increase safe and productive use of nontraditional water sources.
5. Promote responsible energy operations with respect to water quality, ecosystem, and seismic impacts.
6. Exploit productive synergies among water and energy systems.

New Mexico must establish a strong position in addressing these key challenges by advancing the technology continuum—from research and development to demonstration and deployment. Actions such as these will not only address statewide challenges, but will also allow access to valuable opportunities and returns that exist at the nexus of these two crucial resources.

Bioscience

The Bioscience sector covers the life sciences—from agriculture and environment to biomedical and biotechnology. Biotechnology is technology based on biology. Biomedical sciences involve developing knowledge, interventions, or technology for use in healthcare. In the United States, the bioscience industry has contributed more than 1.6 million jobs with wages 79% above the average private sector wage. This is in addition to five million jobs resulting from the economic multiplier effect. Wages in the industry have grown more than 13% (in real terms) since 2001, compared with the 4.4% increase in wages in other industries (BIO 21).

New Mexico is poised to become a key player in this industry because of the established, respected, and growing bioscience assets present in the state, spanning from our roots in agriculture and environmental sciences to the decades of education, research and practice in medicine and health sciences. For example, University of New Mexico Health Sciences Center is host to a National Institute of Health designated Clinical and Translational Science Center. Academic and industry experts in our focus groups assert that New Mexico has a workforce capable of supporting the biotechnology industry and catalyzing innovation and technology commercialization. Business-focused infrastructure already exists in the state, including the Bioscience Lab at the Santa Fe Business Incubator and the Bioscience Center, a privately funded business incubator dedicated to the bioscience industry. Other drivers of commercialization and opportunity in this sector include complementary multi-disciplinary technologies such as nanotechnologies, photonics, advanced computing, and modeling and simulation.

Water/Energy/Food Nexus

In 2012, the **National Intelligence Council** (NIC) published a document entitled "Global Trends 2030: Alternative Worlds" in which they identify four global megatrends, listed below. The Food/Water/Energy nexus identified by the NIC is also recognized and prioritized by the National Science Foundation and U.S. Dept. of Agriculture. This is a very important megatrend to incorporate into New Mexico's planning and investment to address the needs in our state and to forge opportunities in global markets.

Four Global Megatrends:

1. **Food, Water, Energy Nexus:** Demand for food, water, and energy will grow by approximately 35, 40, and 50 percent respectively owing to an increase in the global population and the consumption patterns of an expanding middle class. Climate change will worsen the outlook for the availability of these critical resources. Tackling problems pertaining to one commodity won't be possible without affecting supply and demand for the others.
2. **Individual Empowerment** will accelerate because of poverty reduction, growth of the global middle class, greater educational attainment, widespread use of new communications and manufacturing technologies, and health-care advances.
3. **Diffusion of Power:** There will not be any hegemonic power. Power will shift to networks and coalitions in a multipolar world.
4. **Demographic Patterns:** The demographic arc of instability will narrow. Economic growth might decline in "aging" countries. Sixty percent of the world's population will live in urbanized areas; migration will increase.

Photonics

Photonics is a wide reaching, enabling technology that positively affects virtually every category of Gross Domestic Product (GDP). The global core photonics industry is valued at $156 billion and is growing at a 7% Compound Annual Growth Rate (CAGR). Photonics touches everything from automotive parts and assembly manufacturing to telecommunication systems, pushing the global photonics-enabled industry to $780 billion (Photonics 2). There is great potential for New Mexico companies to prosper by capturing even a small share of global photonics market.

New Mexico's nearly 100 photonics companies employ more than 6,000 people and produce $28 billion in end product value per year (Photonics 17), with systems-based product companies being the most numerous, and component-based product companies bringing in the most revenue. In addition, a combination of small, research-for-hire, startup, and manufacturing companies also operate in New Mexico. Intellectual property is a significant aspect of the local industry. Since 2009, over one third of patents granted to New Mexico entities are related to photonics.

This industry's foundation is strong in New Mexico and greater potential exists—from the quality of workforce and technology expertise to photonics-based facilities such as the Center for Integrated Nanotechnologies. New Mexico's photonics-related assets are well documented in the recently published "Photonics in New Mexico: Diverse Industry Poised for Growth". Much of this strong foundation is attributable to several decades of the Air Force Research Laboratory's research in optics, laser systems, high power electromagnetics, weapons modeling and simulation, and directed energy and electro-optics for space superiority. The AFRL business model involves significant contracting to universities and the industry base. Foundational strength is also manifest in consistent collaboration among industry professionals and burgeoning entrepreneurial focus at New Mexico universities (Photonics 20).

New Mexico has the requisite elements for developing a cohesive optics/photonics community, and for developing a strategy based on the "2014 Photonics in New Mexico" report. The development of a clustering strategy is important for optimizing and validating the state's capabilities in the U.S. and internationally. The cluster will also create a more connected and collaborative optics community and aid in solving problems in the industry including supply chain constraints and continued growth in education and workforce development, marketing and branding.

THE INNOVATION AND ENTREPRENEURIAL ECOSYSTEM

The innovation assets and entrepreneurial support resources in a region are key determinants of the region's ability to convert innovations to wealth and job creation. A comprehensive and holistic program in New Mexico that enables a vibrant innovation and entrepreneurial ecosystem is envisioned. It would include funding for technology maturation, endowed research chairs and innovation centers, start up and seed capital, matching funds for federal and private grants, advancement and branding of our industry clusters, and business management and entrepreneurial development and recruitment.

Figure 1. INNOVATION AND ENTREPRENEURIAL ECOSYSTEM

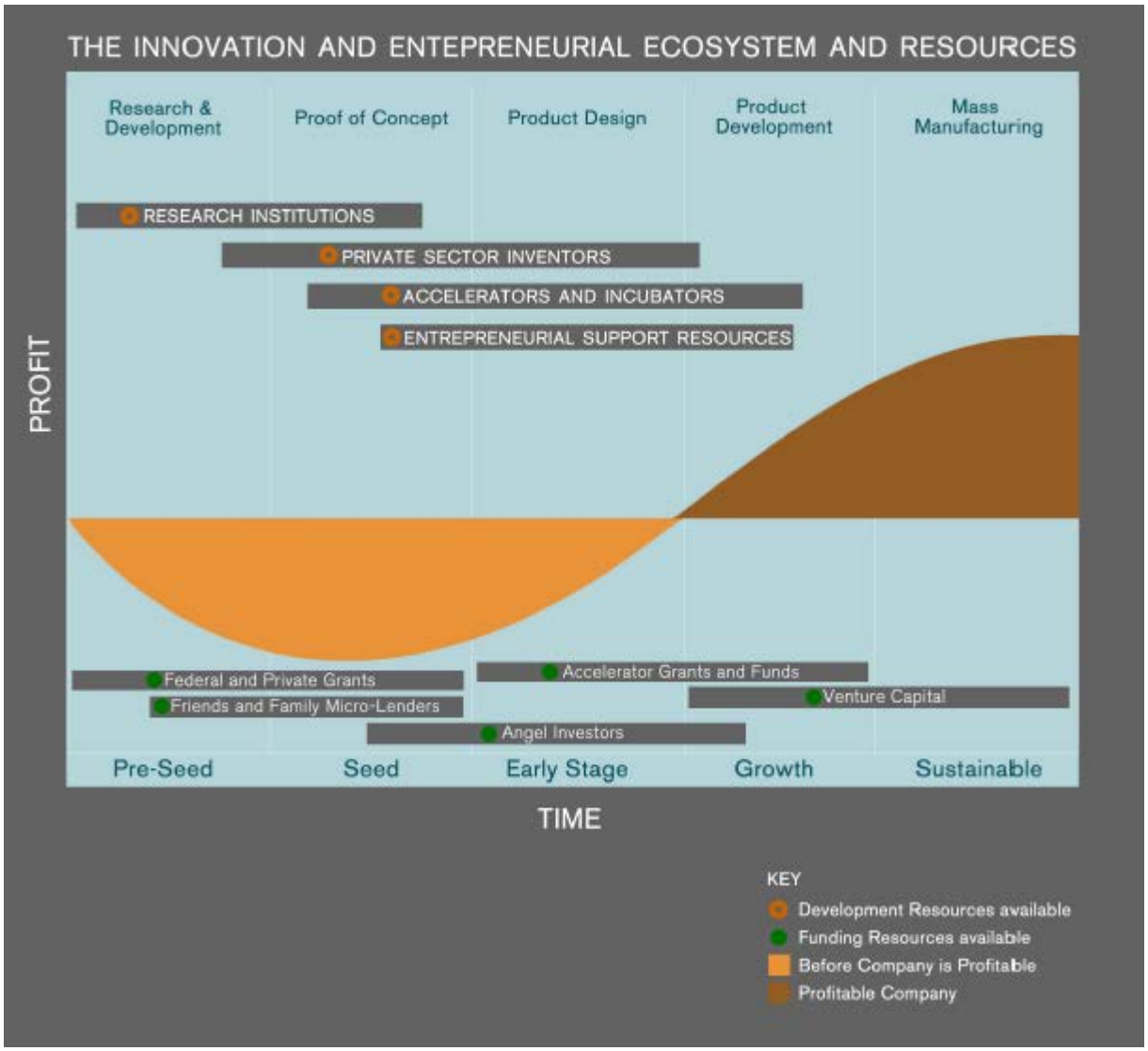


Figure 1 above presents a notional view of the New Mexico innovation ecosystem, with the technology commercialization continuum (Research and Development, Proof of Concept, Product Design/ Development to Manufacturing) across the top and the funding continuum across the bottom. Also shown are the innovation assets and entrepreneurial support resources. A key takeaway from this chart is the conceptual illustration of the growth in profitability at the point of scale up and manufacturing. Converting research to scalable products and manufacturing is where job creation and economic prosperity are realized.

Innovation Assets

Innovation assets are research institutions including universities, federal laboratories, research facilities, and private sector researchers. Since the 1930s, New Mexico has been the site of groundbreaking scientific research. The National Laboratories have drawn scientists and research organizations from all over the world to New Mexico. New Mexico's legacy includes over five decades of $6 to $12 billion annually in R&D funding, which has created extensive and diverse capability in national security and defense, aerospace, health, medicine and biosciences, fossil and renewable energy, and more.

Research Institutions in New Mexico include: University of New Mexico, University of New Mexico Health Sciences Center, New Mexico State University, New Mexico Institute of Mining and Technology (NM Tech), Air Force Research Laboratories, Sandia National Laboratories, Los Alamos National Laboratories, New Mexico Consortium, Lovelace Respiratory Research Institute, MIND Research Institute. Much of the history of science and technology in the region started with the birth of military operations, and the state is host to Kirtland Air Force Base, Cannon Air Force Base, Holloman Air Force Base, and US Army White Sands Missile Range. The New Mexico Spaceport, 18,000 acres and 12,000 foot spaceway located 45 miles north of Las Cruces, is the world's first purpose-built commercial spaceport.

New Mexico's innovation assets go well beyond the funding and facilities at our universities and the three federal laboratories located here. The wealth of human capital in the state's asset pool includes numerous well-educated, experienced, and distinguished scientists and engineers who work and live in the state, and who also teach, mentor, retire, invent, invest, and may start or join companies here.

Entrepreneurial Support Resources

Because start-up and small businesses bring many of today's innovative products and processes to the marketplace, entrepreneurial support resources should be robust and easily accessed. Entrepreneurial support resources include open access to research facilities and physical space, incubators and accelerators, seed funding, manufacturing extension programs, technology development resources, marketing and technical assistance, active business and collaboration networks, specialized service providers, experienced executive management, and an active, enthusiastic and supportive culture.

New Mexico's entrepreneurial support resources include several incubators and technology parks; accelerators, co-working and synergy centers angel investment networks, business collaboration events; and training and mentoring on topics such as intellectual property, pitching an "investible" business plan development, management, and marketing. Innovate ABQ and Albuquerque's burgeoning Innovation District, which includes private and public facilities and resources, is packed with activity. The award winning New Mexico Small Business Assistance (NMSBA) Program allows New Mexico small businesses facing a technical challenge to access the unique expertise and capabilities of Los Alamos and Sandia National Laboratories. At no cost to the business, small businesses with a technical challenge can receive assistance from lab scientists or engineers for projects that require testing, design consultation and access to special equipment or facilities that are not available in the private sector.

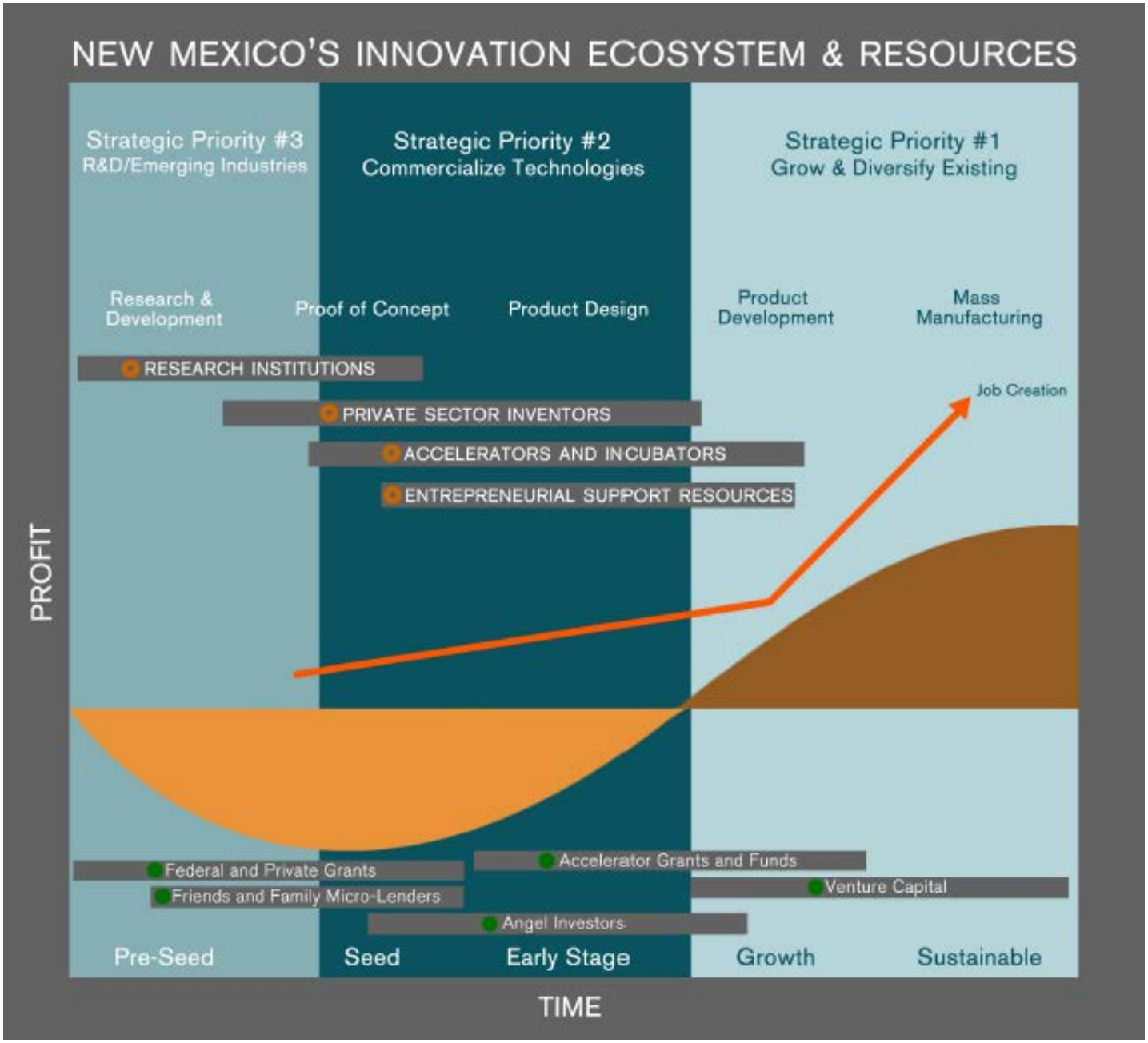
New Mexico has very high per capita federal research funding and a comparably low per capita matching investment from the state. Investment from the state is an essential complement to the federal research funding, so that it can be leveraged to achieve our potential in private sector job creation. The NMSBA program represents $5M annual investment from the state for over 20 years. There is an opportunity to further position New Mexico companies and attract others to relocate here if we were to consider raising the NMSBA investment amount for technology maturation and proof of concept of new technologies.

Recruiting researchers and endowed chairs is critical, and continued growth in funding for endowed chairs and innovation centers can cause recruitment to complement existing local activity. All the entrepreneurial support resources will not “move the needle” unless there is sufficient seed capital to support funding the best ideas. The need for early stage and seed capital for technology ventures cannot be overemphasized. The Venture Acceleration Fund from Los Alamos has provided seed funding to many start-up ventures in Northern New Mexico, and continues to evolve in vetting and funding distribution. While there are some early stage venture investors in New Mexico, there remains a significant gap in start-up and early stage capital, as well as growth and expansion capital. Filling the funding and investment gap is a high priority.

STRATEGIC PRIORITIES AND GOALS

The framework shown below in Figure 2 portrays overall priorities in the context of the Innovation and Entrepreneurial Ecosystem described in Figure 1. The three Strategic Priorities of **growing and diversifying existing technology companies, rapidly commercializing technologies,** and **research and development in emerging technologies** will provide a foundation that allows us to maximize the major improvements made in business tax policy and further leverage federal research investments. These priorities provide a high-level roadmap for moving forward, and the goals within each priority are the basis for annual action plans and metrics.

Figure 2. The Innovate! New Mexico Planning Framework



Strategic Priorities and Goals

STRATEGIC PRIORITY #1: Grow and Diversify Existing Technology Companies

Support and assist New Mexico's existing technology companies to positively affect their growth, diversification and global competitiveness.

Goal #1: Complete a statewide defense supply chain mapping study that will identify workforce, technology and product vulnerabilities and economic assets in the state.

Goal #2: Develop diversification assistance strategies for the state and for companies impacted by reductions in Department of Defense budgets.

Goal #3: Develop industry cluster strategies for Photonics, Bioscience Water and Energy.

Goal #4: Support international trade and export as a growth and diversification strategy.

Goal #5: Continue to improve New Mexico's business climate.

STRATEGIC PRIORITY #2: Commercialize Technologies and Innovations

Enable the creation of commercial enterprises from technologies invented in New Mexico

Goal #1: Develop a plan and operational concept for the Technology Research Collaborative (TRC).

Goal #2: Obtain seed funding to mature technologies and fund early stage technology commercialization ventures.

Goal #3: Expand incentives that benefit early stage technology companies.

Goal #4: Engage EPSCoR in technology commercialization projects, particularly in the areas of water, energy, food, and their nexus, to further enable research translation.

Goal #5: Develop programs to accelerate commercialization of technologies developed with the Small Business Innovation Research (SBIR), and Technology Transfer Research (STTR) awards in New Mexico.

STRATEGIC PRIORITY #3: Increase Research and Development Capacity

Position New Mexico universities and companies, in partnership with national laboratories, for research and development programs in key emerging technology areas.

Goal #1: Develop a strategy, in partnership with Air Force Research Laboratories (AFRL), to build and recruit a regional industry base for development and integration of directed energy and satellite systems.

Goal #2: Set aside a fund to enable matching funds for research and development grants.

Goal #3: Attract researchers, entrepreneurs, inventors, investors, and business managers through funding for endowed chairs, collaborations and public-private partnerships.

STRATEGIC PRIORITY #1: Grow and Diversify Existing Technology Companies

Support and assist New Mexico's existing technology companies to positively affect their growth, diversification and global competitiveness.

With a focus on the growth and diversification of existing technology businesses in the state, we address the needs of those who are currently investing in our state economy. By recognizing and celebrating our "gazelles," or high-growth companies, we create excitement and role models across the state. New Mexico's recent tax incentives for manufacturers and its advantage for international trade and export are important enablers for growth and diversification. Complementary programs that help companies advance manufacturing and export capability can maximize the benefits and bring significant job and wealth creation. By ensuring that existing companies diversify, grow and thrive, we have created an environment that also supports start up businesses and strengthens our potential to attract and recruit innovation-based companies.

Many technology companies in the state have started and developed based on opportunities with defense and national security contracts in myriad areas of technical, engineering, research and development services. Due to cuts in federal budgets, there is a need to implement strategies to assist these companies in diversifying in order to reduce their reliance on defense and government spending. If engineering and prototyping companies can move toward product development and manufacturing, they will be able to realize scalable growth and wealth creating exits, such as acquisitions or initial public offerings. If we can assist technical service providers in refining and/or re-packaging their capabilities, they can potentially expand and diversify by selling to non-defense, commercial businesses. Such assistance programs, once developed, would be available to all companies in the state.

Goal #1: Complete a statewide defense supply chain mapping study that identifies workforce, technology and product vulnerabilities and economic assets in the state. (2015–2016)

New Mexico has received funding from the Department of Defense (DOD), Office of Economic Adjustment (OEA), for a Defense Industry Diversification program. The first phase of the project is to assess New Mexico's defense suppliers. We will identify at-risk businesses within the defense supply chain, the resulting economic or strategic impact on the state and/or nation, and identify other state assets that might support the development of adjustment and diversification strategies. We will stand up a communication portal to create awareness and collaboration across the state.

Goal #2: Develop diversification assistance strategies for the state and for companies impacted by reductions in Department of Defense budgets and for the state. (2016–2017)

Goal #1 outputs coupled with additional market and industry research will provide a basis for developing statewide diversification strategies and develop assistance programs. Defense industry assistance programs in other states offer capability analysis services and market research studies for new business strategies. For example, companies that have provided quality and safety compliance services to the Nuclear Weapons Complex may only have to re-package their capabilities to serve other highly regulated industries such as biomedical or commercial space. Another example, a company providing environmental cleanup services will have geo-hydrologists and engineering capability that may serve advanced renewable energy and water sectors. Yet another example is a company that developed optics-enabled systems for defense satellites that may need customer and market development assistance to move their advanced systems into commercial, non-defense markets.

Goal #3: Develop industry cluster strategies for Photonics, Bioscience (2015–2016), Water and Energy. (2016–2017)

The supply chain and asset map accomplished in Goal #1 will provide data and analysis of industry clusters and other assets across the state that might support the development of adjustment and diversification strategies. Working with industry associations, researchers, and experts, we will complete an industry sector study for the other key sectors; i.e., bioscience, water, and energy, much like the study "Photonics in New Mexico; Diverse Industry Poised for Growth". These studies generate a basis for developing industry cluster strategies in each particular sector.

"Cluster-based economic development," which links healthy growth sectors and businesses together, is an approach that has become widely accepted by economic developers in the past few years. It involves applying strategies that build on existing concentrations of competing, complementary and interdependent firms within sectors to enhance a region's competitive advantage. Based on the study, "Photonics in New Mexico; Diverse Industry Poised for Growth", New Mexico has the key elements to develop a photonics cluster strategy working with the nmOptics and other experts. (nmOptics is an industry-based, 15-year old non-profit association whose mission is to promote the growth and development of the optics industry in New Mexico.) A cluster strategy will also aid in branding and solving problems in the industry such as supply chain constraints, thereby creating a more connected, collaborative optics/photonics community. The photonics industry is on the wake of a global revolution, so this is a prime opportunity to develop and market New Mexico's advantages in the industry.

Convergence of the activities of universities, research facilities, educated workforce, and the private sector will benefit the growth and commercial potential of New Mexico's bioscience sector as well, so the NMEDD/OST plans to support the completion of a similar study of biomedical-related assets, and to develop a competitive positioning strategy for New Mexico in the transforming, growing bioscience sector.

It is important to perform a study and develop a cluster strategy with the water and energy sectors as well. Collaboration among professionals across the industry will help to leverage existing research and development, more effectively develop technologies that are viable for commercialization, and realize opportunities to reach new markets. These activities can position the state to build and attract a more robust pipeline of water and energy industry experts and encourage entrepreneurial endeavors.

Goal #4: Support international trade and export as a growth and diversification strategy. (Ongoing)

For New Mexico companies, export and trade opportunities with Mexico are particularly promising due to our state's investment and relationship development. Since 2011, global exports from New Mexico have grown 253% from $1.5 billion to $3.8 billion, and exports to Mexico have grown nearly 400% from $429 million to $1.5 billion. In 2014 alone, exports to Mexico grew by 93%. New opportunities are emerging quickly with Mexico because of the development of a 70,000 acre master-planned bi-national community around the Santa Teresa/San Jerónimo border crossing. This bi-national community is the first of its kind and is anchored by the Union Pacific (UP) intermodal facility and the 640-acre Foxxcon manufacturing campus in Chihuahua.

Seventy percent of younger firms are already thinking of international expansion, suggesting that they are 'born global' entrepreneurs, according to Accenture's G20 study in April 2014, "The Promise of Digital Entrepreneurs: Creating 10 Million Youth Jobs in the G20 Countries" (Promise). In addition, the study claims, "innovation- and export-driven companies are more likely to create jobs." The study also asserts that global expansion can create a number of challenges for entrepreneurs, such as finding the right partner, building local market knowledge, understanding local regulations, finding local skilled resources, and managing logistical costs.

The state can work with international trade experts and organizations locally and nationally and develop training and development programs to assist tech entrepreneurs with developing strategies for growth in exports.

Goal #5: Continue to Improve New Mexico's business climate. (Ongoing)

Tax incentives and policies that benefit growth, attraction and retention of technology companies in New Mexico are essential to assure that New Mexico *retains* the companies as they grow. As shown in the Innovation and Entrepreneurial Ecosystem diagrams, the potential for economic prosperity occurs when research investments are converted to scalable manufacturing. We will continue to work with our start-ups, gazelles, and investors to understand additional tax and policy barriers to growth. As we understand these barriers, we will work to address them in order to ensure the maximum potential of these companies can be realized in New Mexico.

STRATEGIC PRIORITY #2: Commercialize Technologies and Innovations

Enable the creation of commercial enterprises from technologies invented in New Mexico.

Commercializing technologies is the process of converting research and innovations into new businesses and jobs, and bringing benefits to society such as quality of life, medical, security and more. The U.S. leads the world in scientific and medical research and innovative ideas, and New Mexico has a comparably large share of that research and innovation. Investment to bring innovations to the market enables New Mexico to realize the larger economic benefits and returns from those federal R&D investments. Commercialization can take many forms, such as: cooperative partnerships among labs, industry and universities; licensing of patents and other intellectual property; converting an invention to a product or service (prototype, design, develop and manufacture), and knowledge transfer to users of the technology, product or service. Commercialization is historically very challenging, is not always a straightforward process, and may require significant investment for success. As a result, we must continue dedicated efforts to streamline processes, overcome barriers to gain return on our investments in science and entrepreneurs.

New Mexico has opportunities in the applications of hard sciences, as well as in advanced computing and information technologies. With the billions of dollars invested in the state in hard sciences, there is a rich intellectual property base and a depth in human capital, creating the potential for New Mexico companies to compete in global markets. However, the time to market can be long and the therefore, there is a larger investment required. An engineered product based on hard science research and patents take an average of three to five years with $5 to $10 million at stake or more. Comparatively, information technology applications can be prototyped in a weekend, tested with low risk and can be easily improved or pivoted with software revisions. Software-based firms may realize economic impact in a short time, as they result in rapid launch of new businesses based on growing social media and relatively inexpensive and widely accessible mobile electronic tools. Hard sciences, while longer time to market, are often viewed as more sustainable and reliable as a job creator, and are often more likely to receive patents so that ownership and protection of IP are ensured. Whatever the technical focus of a project, the emphasis in evaluating investments should be based on scalable, innovative business models and validated customers and markets.

State programs that have been established elsewhere take many forms, as described in the Technology Research Center Study contracted by the TRC, provided as Appendix C. All of those programs direct funding and resources (such as technology maturation and proof of concept funds, mentorship, marketing and training support) to businesses embarking on a license or commercialization project. This is accomplished through a university, non-profit organization, or a state government office. The TRC is currently evaluating an approach to stand up such a program for New Mexico.

Goal #1: Develop a plan and operational concept for the Technology Research Collaborative (2015–2016)

New Mexico's Technology Research Collaborative (TRC) board is appointed and is developing an operational concept and plan. In FY 2015, the TRC contracted three studies to assist in their planning: (1) an evaluation of the projects funded by the former TRC in 2006–2007, (2) Technology Research Centers: An Evaluation of State-Funded Programs Moving Innovations to Market, and (3) Biosensor Commercialization Market and Customer Adoption. TRC provided matching funds to allow the state to secured funding for the DOD OEA grant for an innovation and commercialization pilot program, which will be focused primarily in the photonics sector.

The TRC is dedicated to accelerating the advancement of innovations and job creation in new and existing businesses in New Mexico. The members of the TRC are committed stakeholders to scientific research, education, economic development and STEM education in the state. Each have developed and implemented unique programs to capture their discoveries and intellectual property, enable commercialization or licensing of their respective institutions' intellectual property, and support and encourage the formation and growth of new commercial technology-based businesses. They have significant success and experience in executing these programs. The barrier to success most often noted by TRC members is the lack of funding for technology maturation and proof-of-concept, and seed capital for start-up businesses. With 2015 funding, TRC will identify and fund pilot projects, which leverage their current programs and can be scaled up in the future. These projects will demonstrate benefits and results at various stages of the commercialization continuum, in both Strategic Priorities #2 and #3.

These pilot programs will contribute to the design of a TRC program unique to New Mexico, one that will be implemented with a high sense of responsibility and stewardship of state taxpayer dollars by requiring milestones and metrics, and measured outcomes and results. An example of minimizing risk when funding projects is to deploy training and programs that put structured processes in place for lean start up, business model canvassing and minimum viable product philosophies such as those in the Global Accelerator Network. Incubator and accelerator programs among the TRC members and across the state have experience, knowledge and material that can contribute to this effort.

Goal #2: Obtain seed funding to mature technologies and fund early stage technology commercialization ventures. (2016–2017)

Regions that strive to grow, attract and expand technology businesses *must* provide a number of options for businesses seeking capital for investment, expansion and start-up. There is a need for increased funding for "proof of concept" to mature technologies for market development, and for equity capital in the very early stages of a company. The TRC in pilot projects discussed in Goal #1 and with new funding requests, is seeking to deploy proof of concept and technology maturation funding into promising technologies. NMEDD/OST is investigating options for starting a seed fund with the State Small Business Credit Initiative, a U.S. Treasury Program.

Goal #3: Expand incentives that benefit early stage technology companies. (2016–2017)

New Mexico has numerous tax and financial incentives for businesses, such as Angel Investment Tax Credit, High Wage Tax Credit and others. In order to further support technology-led economic development and technology commercialization, incentives that benefit early stage technology companies should be made as accessible as possible. This can be achieved through awareness and promotion, ease of processing, and reduced or special qualification or entry requirements.

Goal #4: Engage EPSCoR in technology commercialization projects, particularly in the areas of water, energy, food and/or their nexus, to further enable research translation. (2016–2017)

Since 2001, the National Science Foundation EPSCoR has contributed approximately $88 million to New Mexico in direct EPSCoR awards in areas such as sustainable energy, hydrology and aquatic chemistry, climate science and modeling, ecologic research, biomedical engineering, and more. EPSCoR researchers and program managers will be integrated into technology commercialization initiatives to further evolve these research areas into self-sustaining economic activities, particularly as the water and energy cluster studies and strategies discussed in Strategic Priority #1 are underway.

Goal #5: Develop programs to accelerate commercialization of technologies developed with the Small Business Innovation Research, and Technology Transfer Research awards in New Mexico. (2016-ongoing)

New Mexico State University's (NMSU) Arrowhead Center was awarded a Small Business Administration Federal and State Technology (FAST) partnership grant. The FAST Program is designed to stimulate economic development among small, high technology businesses through federally funded innovation and research and development programs like the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR). Among the FAST Program's goals is commercializing technology developed through SBIR grants. NMEDD/OST will work with NMSU Arrowhead Center and other stakeholders to develop and deploy creative ideas that leverage the training at incubators and accelerators into specialized programs. New Mexico receives most of its SBIR funding from DOD agencies. In conjunction with an OEA grant for diversification, programs to move from research- to product-focused development will serve both programs.

STRATEGIC PRIORITY #3: Increase Research and Development Capacity

Position New Mexico universities and companies, in partnership with national laboratories, for research and development programs in key emerging technology areas.

Research is the lifeblood of a high-tech economy. "To expect continued technological advancement and job growth without investing in research is akin to attempting to operate an automobile factory without a loading dock for steel, aluminum, or rubber" (Restoring 9). Competitiveness in today's accelerating high-tech, knowledge-based economy requires innovation and the rapid infusion of new knowledge and technologies. As the U.S. is home to 70 percent of the world's Nobel Prize winners and three quarters of the world's top 40 universities, increased investments and participation in emerging research fronts is essential to feed the innovation pipeline for future generations.

New Mexico must continue to secure R&D funding in many forms. In the Innovate! New Mexico framework, research and development are at the front or left end of the innovation "pipeline" (viewing the Innovation Ecosystem chart on page 9 from left to right, as a feed or pipeline of opportunities). Our investment in a vibrant business climate and a commercialization engine must be matched with investments in research capacity to assure our continued competitiveness. Investment and matching funds for competitive federal research grants are critical to holding a strong position in the increasingly competitive arena of federally funded research and innovation centers.

With three federal research laboratories, three recognized research universities, and an industry base with research support capacity, New Mexico has significant opportunities to partner between government, academia and private industry to exploit key emerging capabilities and a sustainable innovation-based economy to their mutual benefit. This is a strong emphasis of the TRC.

Goal #1: Develop a strategy, in partnership with Air Force Research Laboratories, to build and recruit a regional industry base for development and integration of Directed Energy and Satellite systems. (2016)

The AFRL spends 40% of its overall budget in contracted research and development with small and large businesses. New Mexico AFRL Directorates, Directed Energy and Space Vehicles located on Kirtland AFB have strategic research, industry and educational partnerships in New Mexico. New Mexico's 2015 tax package enables receipts from the sale by a qualified contractor of qualified R&D services in directed energy and satellite-related inputs may be deducted from gross receipts when sold via a contract with the US DOD. The purpose of the deduction is to promote new and sophisticated technology, enhance the viability of directed energy and satellite projects, attract new projects and employers to New Mexico, and increase high-technology employment opportunities in New Mexico. The State of New Mexico will work with industry associations such as Professional Aerospace Contractors Association (PACA), nmOptics, and Directed Energy Professional Society (DEPS) and their member companies to increase expansion and relocation to New Mexico.

Goal # 2: Set aside a fund to enable matching funds for federal research and development grants and programs. (2016–2017)

Federal research and development grants are increasingly more competitive, and always require matching funds. A consistent and robust fund for required matches upon award of R&D grants is mandatory for healthy R&D capacity expansion. Opportunities for new funding will emerge outside of the typical legislative funding cycle. A reserve fund will enable institutions to effectively compete for research grants.

Goal #3: Attract researchers, entrepreneurs, inventors, investors, and business managers through funding for endowed chairs, collaborations, and public-private partnerships. (Ongoing)

Advanced Technology Centers and Innovation Centers are public-private partnerships associated with a university and are the result of a conscious effort to bring together researchers and industry to foster the growth of new and emerging high-tech companies. These centers can become a means of attracting world-class researchers, entrepreneurs and investors to a region. They can also complement an industry-clustering strategy to fulfill a complete regional strategy. NMSU's Water Resources Research Institute, UNM's Center for High Tech Materials, and UNM's Clinical and Translational Science Center are a few of the existing centers that can increase their impact with additional investment. Endowed chair funding should complement this effort.

CONCLUSION

Innovate! New Mexico recommends realistic, achievable near-term actions to jump-start technology business growth and make New Mexico a place in which innovators and entrepreneurs can thrive. It provides a framework for context and communication among stakeholders, while establishing priorities and goals that produce a thriving base of technology companies. This outcome is critical to fulfilling our intent to build a diverse, knowledge-based economy across the state. By following the recommendations in this plan, we can begin to convert the decades of R & D spending in the state and the rich base of human and natural resources into regional economic prosperity.

Creating an innovation- and technology-led economic base in New Mexico requires commitment and continuous, long-term investment in a partnership between the public and private sectors. A sense of urgency is at hand as we face threats such as declining federal budgets, fluctuations in the oil and gas markets, and competition from other states for high-tech jobs. Many important accomplishments that support this plan are underway, such as the highly positive changes to the state's business taxes, the reinstatement of the Office of Science and Technology and the Technology Research Collaborative, funding from Office of Economic Adjustment, Defense Industry Diversification program, and complementary investment from New Mexico State Government. The state-wide, collaborative, start-up and entrepreneurial community is already flourishing, and is positioned for expansion and growth.

Implementation of this plan began in July 2015, and will evolve over the months and years ahead based on increasingly meaningful results, securing additional funding, and ongoing stakeholder engagement. Following the deliberate course of action detailed in this plan will ensure that New Mexico meets its technology commercialization objectives while keeping a keen eye on the dynamic and evolving technology environment. In so doing, we will remain flexible and positioned to respond to opportunities and challenges as they arise.

APPENDIX A. PLAN FOUNDATION

The drive to enable and support innovators and entrepreneurs informs the recommendations made in this plan. In addition, the plan includes key takeaways from the NMEDD 5-Year Plan, focus groups convened by NMEDD, a Technology Research Center Study sponsored by the Technology Research Collaborative (TRC), and the Milken Institute's 2014 "State Technology and Science Index". The priorities and framework of the plan are also designed to maximize the favorable improvements in the state's business tax climate.

"Innovation Creates Diversification—NMEDD 5-Year Plan for Strategic Economic Growth & Diversification 2013–2018"

NMEDD's "Innovation Creates Diversification—5-Year Plan for Strategic Economic Growth & Diversification" states that, "In economic development, [innovation] represents the evolution from a production-based economy to a broader view that embraces innovation and the development of a knowledge economy" (Innovation 3). This assumption is at the heart of "Innovate! New Mexico—New Mexico Science & Technology Plan".

Of the eight priorities in "Innovation Creates Diversification-5-Year Plan for Strategic Economic Growth and Diversification", one is termed Innovation → Enterprise → Economic Development, or I→E→E. I→E→E discusses innovation or technology-led economic development and the importance of successfully growing intellectual property and technologies developed in New Mexico into profitable companies (Innovation 14).

I→E→E explores the elements necessary to create an optimal "culture of innovation" and cites examples of comprehensive state technology transfer programs and initiatives. These important initiatives include investments in infrastructure, seed funds and talent, support for the research institutions where ideation occurs, and assistance and resources for the entrepreneurial network necessary to grow ideas into gazelles. Of key importance is that these investments produce true, sustainable, economic growth and wealth creation.

Focus Groups

In support of the Science and Technology Commercialization Plan, NMEDD proactively solicited industry expertise to identify sector-specific trends in water, energy, bioscience and photonics. This plan is based in part on the assessments and insights provided by numerous focus groups and one-on-one interviews.

An independent consulting firm sponsored by Public Service Company of New Mexico (PNM) engaged industry experts and thought leaders with technical, academic and economic development expertise through one-on-one, in-depth interviews and focus groups. In all, 19 leaders were interviewed in advance of the focus groups with each telephone interview lasting approximately one hour.

EPSCoR hosted four six-hour focus group sessions (on water, energy, bioscience and photonics), attended by a total of 48 external industry experts. NMEDD employees and consultants participated in the sessions. Participants received the I→E→E section of the state's "Five Year Plan for Strategic Economic Growth & Diversification" as well as "thought-starter" questions to maximize session value and productivity.

These forums allowed us to better understand the key internal and external factors that impact participants' future successes, and any remaining obstacles and issues that exist in New Mexico.

Technology Research Centers Study

A study entitled "Technology Research Centers: An Evaluation of State-Funded Programs Moving Innovations to Market" was contracted by the TRC and completed by the New Mexico Angels in January 2015. This study examines successful state-funded programs devoted to the facilitation of commercializing university and laboratory innovations and creation of start-up companies, which will inform the TRC's efforts to create a successful model in New Mexico.

The study evaluates state-funded technology commercialization programs in Texas, Arizona, Utah, Nebraska, California, Oklahoma, and Massachusetts. These states were selected based on the success of their programs, funding from state resources, and their proximity to, or similarity to, the New Mexico economic climate. The analysis of these programs provides valuable insight into how TRC can facilitate the commercialization of innovations for the state.

New Mexico's Competitive Business Tax Climate

Since taking office in January 2011, Governor Martinez has made substantial changes to New Mexico's tax policy, reducing taxes 24 times. She has worked with the New Mexico Legislature to enact significant changes to State tax policy.

The 2013 New Mexico Jobs Package phases in a reduced corporate income tax rate from 7.6% to a maximum rate of 5.9% by January 1, 2018.

Corporate Income Tax Reduction Phases

Year	<$500,000	$500,000 – $1 million	>$1 million
2014	4.8%	6.4%	7.3%
2015	4.8%	6.4%	6.9%
2016	4.8%	6.4%	6.6%
2017	4.8%	6.2%	6.2%
2018	4.8%	5.9%	5.9%

In addition, the bill phases in a single sales factor apportionment methodology for the income of multi-state corporations, whose principal business activity is manufacturing, over the same 5-year period.

In January 2014 she was 1 of 6 governors recognized by the nonpartisan Tax Foundation for Outstanding Achievement in State Tax Reform. Also, in January 2014, Ernst & Young published a study on tax competitiveness and found that New Mexico has the best tax climate for manufacturers in the nine-state western region. In August 2014, Kiplinger named New Mexico the 8th Most Tax Friendly State, up from 9th in 2013.

In June 2015, New Mexico made a sizeable jump on CNBC's 2015 "America's Top States for Business" scorecard, jumping from 37th to 24th place in the nation. The improvement is tied for the first in the U.S. The June 2015 jobs package renews and expands key tax incentives aimed at building on New Mexico's success of becoming more business friendly. Those incentives include a Corporate Headquarters tax exemption, an expansion of the New Mexico Angel Investment Credit, a gross receipts deduction for directed energy and satellite research and production, and an increase to $50 million for the state's Local Economic Development Act (LEDA) "closing fund".

New Mexico Business Tax Incentives

Details about the specific tax incentives can be found at NM EDD website, www.gonm.biz

- Advanced Energy Deduction & Advanced Energy Tax Credit
- Aircraft Deduction
- Alternative Energy Product Manufacturer's Tax Credit
- Angel Investment Credit
- Beer & Wine Producers' Preferential Tax Rate
- Biodiesel Blending Facility Tax Credit
- Biomass-Related Equipment & Materials Deduction
- Consumables Gross Receipts Tax Deduction for Manufacturers
- Directed Energy & Satellites
- Film Post Production Services 25% Refundable Tax Credit
- Financial Management Tax Credit
- High Wage Jobs Tax Credit
- Investment Tax Credit for Manufacturers
- Locomotive Fuel Gross Receipts & Compensating Tax Exemption
- Military Acquisition Program Tax Deduction
- Renewable Energy Production Tax Credit
- Research and Development Tax Deduction
- Rural Jobs Tax Credit
- Rural Software Development Gross Receipts Tax Deduction
- Single Sales Factor
- Space Gross Receipts Tax Deductions
- Technology Jobs & Research and Development Tax Credit
- Texas/New Mexico Border Residents' Tax Exemption
- Trade Support Company in a Border Zone
- Web Hosting Gross Receipts Tax Deduction

Milken's 2014 "State Technology and Science Index"

For over a decade, The Milken Institute has been tracking and examining factors behind technology-based economic development in the United States in its "State Tech and Science Index." This study measures 78 components that leading states use to build and maintain their positions in high technology. This information has been used by states to develop their strengths and improve their ranking.

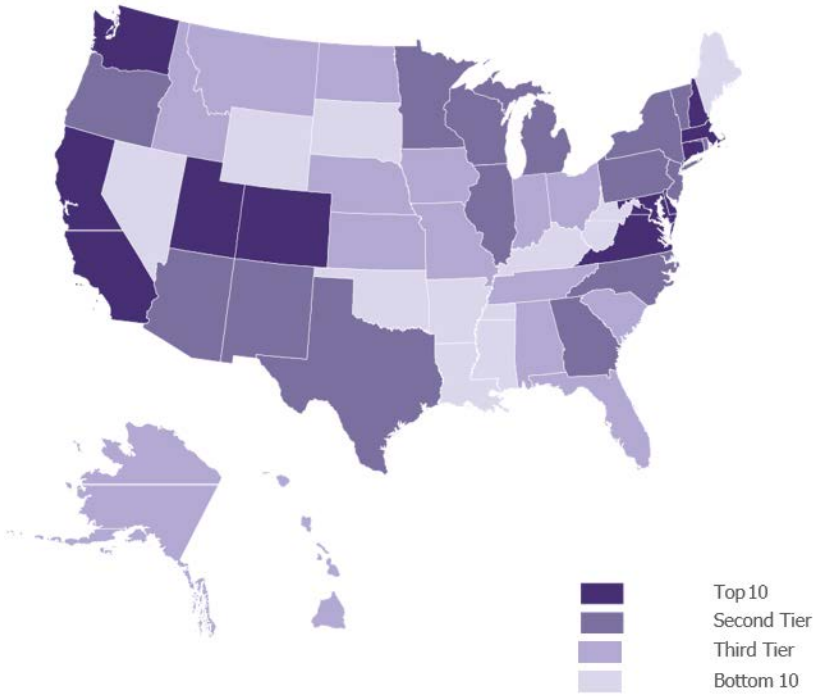
New Mexico's rankings have declined overall between 2012 and 2014, as measured by the five ranking areas in the following table. During this period, New Mexico improved in one category—**Technology and Science Workforce**, stayed the same in two areas—**Risk Capital Infrastructure** and **Human Capital Infrastructure**, declined in the **Research and Development Inputs**, and dropped significantly in one category—**Technology Concentration and Dynamism**. Overall, this represents a two-place ranking drop over the preceding two years.

State Technology & Science Index Ranking Areas	Rankings 2014	 2012	 +/–
Research and Development Inputs – New Mexico's Research and Development (R&D) capacity has decreased in terms of facilities that have the potential to attract funding and commercialize innovations. Measures of R&D include industrial, academic, and federal R&D; Small Business Innovation Research awards; and the Small Business Technology Transfer program.	15th	12th	–3 loss
Risk Capital & Entrepreneurial Infrastructure – New Mexico has stayed the same in terms of possessing the right ingredients to enable it to convert research into commercially viable technology-related products and services. Measures of venture capital activity and entrepreneurial pursuits include patenting activity, business formations, and initial public offerings.	30th	30th	Same
Human Capital Investment Infrastructure – New Mexico has stayed the same in terms of investing and developing its workforce, which is its most important intangible asset, and crucial to its success and viability in the tech-based economy. Workforce skill levels are measured by the number of STEM and bachelor's, master's and doctorate degrees relative to New Mexico's population.	25th	25th	Same
Technology & Science Workforce – New Mexico has improved its technology and science workforce strength and intensity in terms of its depth of high-end technical talent, which is a key positive indicator of New Mexico's ability to staff tech-based businesses. Workforce intensity is derived from the ratio of employment in a particular field vs. total state employment in 18 occupation categories and computer and information sciences, life and physical sciences, and engineering.	18th	20th	+2 gain
Technology Concentration & Dynamism – New Mexico gave up four spots in its state ranking, which may indicate that state policymakers and other stakeholders have not been effective at strengthening and growing the tech-based economy within the state, particularly relative to other states. Measures include percent of establishments, employment and payrolls in high-tech categories.	31st	27th	–4 loss
Overall ranking drop over two years:	**24th**	**22nd**	**–2 loss**

This graphic illustrates the rankings of all states divided into four tiers.

Colorado and Utah are neighboring, mountain west states, both of which advanced to the top tier in 2014, surpassing New Mexico.

They are realizing the returns on their efforts and investments in science and technology-led economic programs.



- Colorado's program assists technology startups through the Advanced Industries Accelerator grant program ($12.5M annually) and the Advanced Industry Investment Tax Credit.

- Utah owes its high ranking to the state-funded Utah Science and Technology Research Initiative (USTAR), which has recruited 50 star scientists to Utah's universities from MIT, Harvard University, UCLA, Case Western, University of Arizona, and Oakridge National Laboratory.

ACKNOWLEDGMENTS

The New Mexico Economic Development Department (NMEDD) thanks the many talented individuals and organizations whose volunteer contribution of time and insights were essential to the development of this plan. Together, we are building a more technologically capable and opportunistic future for New Mexico.

TECHNOLOGY RESEARCH COLLABORATIVE

Air Force Research Laboratory (AFRL)
Casey DeRaad
Robert Peterkin
Greg Spanjers

Governor Appointees
Larry Alei
John Liebman
Larry Stolarczyk
Doug Thiessen
Lori Upham

Los Alamos National Laboratory (LANL)
Micheline DeVaurs
Duncan McBranch

New Mexico State University (NMSU)
Garrey Carruthers
Kathryn Hansen

New Mexico Institute of Mining and Technology
Dan Lopez
Van Romero
Richard Cervantes
Warren Ostergren

Sandia National Laboratories (SNL)
Robert Leland
Andrew McIlroy

University of New Mexico (UNM)
Robert Franks
Chaouki Abdallah
Michael Dougher

_____

NEW MEXICO ECONOMIC DEVELOPMENT COMMISSION

Alex O. Romero, Chair, District 3
Larry Stolarczyk, NM District 2
Trent Dimas, At-Large Member
Ron Solimon, Native American Representative
Doug Redmond, District 4
Joseph Semprevivo, District 5
Janet Green, District 6

FOCUS GROUP & OTHER

Representatives from the Offices of:
Tom Udall, U.S. Senator
Martin Heinrich, U.S. Senator
Michelle Lujan-Grisham, U.S. Representative, 1st Congressional District
Congressman Steve Pearce, U.S. Representative, 2nd Congressional District
Ben Ray Lujan, U.S. Representative, 3rd Congressional District
Lynore Abbott, New Mexico Optics Industry Association
Lisa Adkins, The BioScience Center, Fat Pipe
Ed Archuleta, Consultant/Director, Water Initiatives
Peter Atherton, Sandia Technology Transfer Office
Brian Barnett, SolStar Energy Devices
Craig Beckman, Miox
Brian Birk, Sun Mountain Capital
Sally Corning, Sun Mountain Capital
Dave Blivins, Cottonwood Technology Fund
Kevin Boberg, NMSU Director of Economic Development
Richard Cervantes, New Mexico Institute of Mining and Technology
John Chavez, NM Angels
Patrick Chu, SNL
Bob Curtis, Respira Therapeutics
Mary Jo Daniel, ESPCoR
Ron Darnell, Public Service Company of New Mexico (PNM) Public Policy
Bryn Davis, Sapphire Energy
Imelda De La Rue, PhD., Air Force Research Laboratories,
Dale Dekker, DPS
Terry Dunlay, Intellicyt
Danielle Duran, PNM
Dave Durgin, Verge Fund
Victor Esch, Nano MR
Bob Feinberg, Aeromix
Sam Fernald, NMSU Institute Water Resources Research
Dan Fine, Energy Natural Renewable Oil & Gas
Karin Foster, Independent Petroleum Association
John Freisinger, Technology Ventures Corporation (TVC)
Ned Godshall, Altela
Nick Goodman, Cyrq Energy
Kathryn Hansen, NMSU Arrowhead
Jon Hawkins, PNM Advanced Technologies
Mike Hightower, SNL
Brian Hoover, Advanced Optics
Hong Q. Hou, Emcore
Kerry Howe, UNM Center for Water & Environment
Frank Huang, Osmotic Power Initiative/NM Experimental Program to Stimulate Competitive Research (EPSCoR)
Anne Jakle, ENMRD/Policy
Kirby Jefferson, Intel Corporation
Jack Jekowski, Innovative Technology Partnerships
Sheldon Jordan, Peptineo
David Joseph, AVISA

William Knauf, SNL
Bill Kolb, SNL
Drew Kornreich, Nuclear Energy Research/LANL
Sanjay Krishna, Center for High Technology Materials & Skinfrared
Wish Krishnamoorthy, Qynergy
Lisa Kuttilla, STC.UNM
Dan Laird, SNL
Pete Lammers, NMSU/Algal Bioenergy Program
Richard Larsen, UNM Health Sciences Center
Paul Laur, Eldorado Biofuels
Dagmar Lewellen, Bureau of Reclamation
Yun Li, TechAdvance NM
Trevor Loy, Flywheel Ventures
Jim Manatt, Providence Technologies
Jim McNally, ATA. NMOIA
David Melton, Sacred Power
Bill Michener, ESPCoR
Bill Miera, Fiore Industries
Albert Miglori, Los Alamos National Laboratories
Mark Mimovich, MOOG
Michelle Miller, HD3
New Horizons Computer Learning Center
Luis M. Ortiz, Ortiz & Lopez
Deborah Peacock, Peacock Law
Mark Person, Geothermal Power Initiative/NM EPSCoR
Tony Pino Daniel, Sandia Biotech
Rohit Prasankumar, LANL
Ray Quintana, Cottonwood Ventures
Carol Radosevich, PNM
Ray Radosevich, Verge
Eric Renz-Whitmore, NM Technology Council
Katie Rice, Epic Ventures
Jesse Roach, SNL
Jon Roarke, Boeing Corporation
Stuart Rose, The BioScience Center, Fat Pipe
Bob Sachs, Team Technologies
Andrew Salazar, NM Biotechnology & Biomedical Association & TVC
Dick Sayre, New Mexico Consortium
Angela Schackel Bordegaray, Interstate Stream Commission/State of NM
Randy Shaw Ortiz, Brackish Groundwater National Desalination Research Facility
Mark Shermetaro, Lumidigm
Stuart Schoenmann, Advanced Technology Consulting Group
Belinda Snyder, LANL/Tech Transfer
Peter Soliz, Vision Quest
John Stomp, ABQ Water
Bruce Thomson, UNM Water Resources Program, Ret.
Lori Upham, TechAdvance NM
Scott Verhines, State of NM Office of the State Engineer
Michael Vickers, Maas Bio Labs
Troy Ward, Prime Therapeutics LLC
Stephan Zollner, NMSU

BIBLIOGRAPHY

"Annual Energy Outlook 2012". Energy Information Administration (EIA). 2012, <http://www.eia.gov/forecasts/aeo/pdf/0383%282012%29.pdf>.

"Battelle/BIO State Bioscience Industry Development 2012," 2012, Biotechnology Industry Organization. <https://www.bio.org/sites/default/files/v3battelle-bio_2012_industry_development.pdf>.

"Innovation Creates Diversification—5-Year Plan for Strategic Economic Growth & Diversification." 2013, New Mexico Economic Development Department. <http://gonm.biz/publications/#economic-development-publications>.

Klowden, Kevin, Keough and Barrett, Jason. "State Technology and Science Index." 2014, Milken Institute <http://www.statetechandscience.org/stateTech.html>.

Marino, Mario, "The Innovation Imperative." Stanford Social Innovation Review, 2009, <http://www.ssireview.org>.

"Photonics in New Mexico – Diverse Industry Poised for Growth," 2014, nmOptics <http://spie.org/Documents/Industry%20relations/NM_Photonics_Study_Final_Report_December_2014.pdf>.

"Restoring the Foundation—The Vital Role of Research in Preserving the American Dream" Report Brief, American Academy of Arts & Sciences, 2014, <https://www.amacad.org/multimedia/pdfs/publications/researchpapersmonographs/AmericanAcad_RestoringtheFoundation_Brief.pdf>.

"The Promise of Digital Entrepreneurs: Creating 10 Million Youth Jobs in the G20 Countries" Accenture, G20 Young Entrepreneurs' Alliance, 2014, < https://www.accenture.com/us-en/~/media/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Industries_12/Accenture-Digital-Entrepreneurs-Global-Expansion-Supports-Youth-Employment-in-G20-Infographic.pdf>.