Summit participants urged to read this report before the event.
Summit details: October 2, 2012, Albuquerque, NM

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New Mexico Economic Development Department

ADDITIONAL SUPPORT PROVIDED BY:
CNM Workforce Training Center
New Mexico Department of Workforce Solutions
New Mexico State University Arrowhead Center

FACILITATOR:
New Mexico First
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FOREWORD

Purpose of the Report
This report will inform the New Century Economy Summit. Participants are urged to review this report prior to attending the event. It is the hope of the organizers that this report also provides valuable resources to policymakers, educators, and advocates – informing future policies and practices affecting New Mexico’s future economy.

The New Mexico Economic Development Department will convene the summit and incorporate the resulting recommendations into its long-term goals and strategic plan. The event takes place October 2, 2012 in Albuquerque, NM.

Convener
The New Mexico Economic Development Department’s mission is to enhance and leverage a competitive environment to create jobs, develop the tax base, and provide incentives for business development. Included in the Economic Development Department are the Economic Development Division, Office of International Trade, Office of Business Advocacy and the New Mexico Film Office. Its administratively attached agencies are the New Mexico Spaceport, Office of Military and Base Planning and the New Mexico Border Authority.

The department is also the lead agency for the New Mexico State Data Center, which is a central point of access for business, economic, and community development data.

New Mexico First
New Mexico First edited this report and will facilitate the upcoming summit using the organization’s unique deliberative model.

The public policy organization engages people in important issues facing their state or community. Established in 1986, New Mexico First offers unique town halls and forums that bring together people from all walks of life to develop their best ideas for policymakers and the public. The nonprofit also produces nonpartisan public policy reports on critical issues facing the state. These reports – on topics like water, education, healthcare, the economy, and energy – are available at www.nmfirst.org.

The state’s two U.S. Senators – Jeff Bingaman and Tom Udall – serve as New Mexico First’s honorary co-chairs. The organization was co-founded in 1986 by Senators Jeff Bingaman and Pete Domenici (retired).

NMSU Arrowhead Center
Arrowhead Center is the lead author on this report. The center was created by New Mexico State University to be an engine for sustainable economic development. It aims to grow new technology companies, retain and expand existing ones, attract still others from elsewhere, and provide systematic, continuous, and adequate assistance to the innovation economy. In addition to doing policy research on economic issues, the organization helps researchers turn scientific discovery into intellectual property. It offers services that enable entrepreneurs to turn new, researcher-developed technologies into viable businesses.

The center also manages the 200-plus acre Business and Research Park for new technology start-ups to locate amongst other established businesses. These businesses in turn hire well-educated employees in high-paying positions.
**INTRODUCTION**

A vibrant economy can create the backbone of a bustling society – with good jobs, high quality of life, adequately funded public services, and rich educational opportunities. By contrast, a stagnant economy can create unemployment, poor wages, fewer individual opportunities, and under-funded public services. Most New Mexicans agree that a growing economy is desirable, but we do not necessarily agree on what that means or how to get there.

A good starting point is agreeing on a definition for economic growth. The Arrowhead Center defines it as “increases in real income and output per capita.”¹ In other words: growth in the amounts of money people earn (real income), and the amount of goods and services they produce (output). “Per capita” essentially means “per person.” So, when economists talk about economic growth, their most basic measure is the individual (not the county, the state, or the nation).

**Employment**

For that reason, increases in population and individual employment obviously influence economic growth. New Mexico (like the nation) lost jobs during the recession beginning in December 2007; our state has not yet regained pre-recession employment levels. In July 2012, New Mexico’s unemployment rate was 6.6%. Non-farm payroll employment (full and part-time jobs) in New Mexico totaled 800,600.² While employment levels have improved since 2010, the current number still represents a loss of 49,000 jobs compared with the beginning of the national recession.³ State employment projections suggest gains in the range of 1% to 1.5% (or 8,000-12,000 jobs) during the next few years.⁴ If the projections are correct, New Mexico will not reach its pre-recession levels of employment until 2015 or 2016.⁵

Employment growth in New Mexico has cooled considerably lately, due to federal government job losses.⁶ However, the private sector has seen job growth. In July 2012, net job growth in the state dropped 0.4% compared to July 2011. This represents a net loss of 2,800 jobs. In contrast, job growth for the entire U.S. rose 1.4% during that time. Oklahoma, Arizona, Texas, Utah, Colorado, and Nevada all had employment gains that were larger than New Mexico from July 2011 to July 2012.⁷

New Mexico’s unemployment rate has improved since its peak of 7.9% in 2010. The unemployment rate was 6.6% as of July 2012 as noted above. The level of New Mexico’s civilian labor force has fallen 1.3% from 2010 to 2011, which means that fewer people are looking for work each month.⁸

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¹ (Peach 2012)
² (New Mexico Department of Workforce Solutions 2012)
⁴ (New Mexico Legislative Finance Committee 2012)
⁵ (Peach 2012)
⁶ (Barela 2012)
⁷ (New Mexico Department of Workforce Solutions 2012)
⁸ (UNM Bureau of Business and Economic Research 2012)
NM Growth Compared to Others
From a long-term perspective, New Mexico’s per capita income growth per year is remarkably similar to the nation’s; both our state and the U.S. averaged about 2% growth per year since 2009. Generally, economists who focus on state-level growth prefer to see their state’s economy growing at a faster rate than the national level. For example, Arizona’s per capita income growth increased almost 4% from 2010 to 2011. Per capita income growth in Texas rose 6.5% during that time. Colorado’s per capita income growth was up almost 6% and Utah’s was 4%. The national average growth rate of per capita personal income was 4.3%.9

A number of both Bush-era and Obama-era tax cuts are scheduled to end on December 31, including the expiration of a Social Security payroll tax cut and the expiration of unemployment benefits that were previously extended.10 Many of the automatic sequestration cuts affect the Defense Department, which will face a $500 billion reduction over the next ten years in January unless Congress steps in.11

The defense budget for Fiscal Year 2013 would be cut $54.7 billion. Cuts would include $2.2 billion from the Air Force’s classified weapons programs and $4.3 billion from Air Force operations in 2013.12

More worrisome for New Mexico, a sequestration in January 2013 would result in $1 billion reduction in the Department of Energy’s National Nuclear Security Administration’s budget. The Office of Science at the Department of Energy would lose $400 million as well.13 The Congressional Budget Office estimates that unless the fiscal cliff and these sequesters are avoided, the U.S. gross domestic product may fall by roughly 2.9% during 2013.14

Because of New Mexico’s economic reliance on Department of Defense and Department of Energy spending, some leaders are particularly worried about our economy.15 The University of New Mexico’s Bureau of Business Research estimated that New Mexico could lose as many as 20,000 jobs if the fiscal cliff is not avoided.16

Federal dollars in New Mexico are especially important in aerospace and defense industries including the national laboratories, military bases, and the three research universities.

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9 (U.S Department of Commerce n.d.)
10 (Congressional Budget Office 2012)
11 (Herald Business Journal September)
12 (Reuters 2012)
13 (Office of Management and Budget 2012)
14 (Congressional Budget Office 2012)
15 (Barela 2012)
16 (UNM Bureau of Business and Economic Research 2012)
**Summit Topics**

This introduction informs all the discussion tracks at the upcoming *New Century Economy Summit*. Additional information on the specific tracks follows in the remaining chapters. Tracks include:

**Tax, Regulation, and Infrastructure Barriers**

GOAL: Develop recommendation for how New Mexico taxes and regulations, as well as our state’s transportation and communication infrastructure, facilitate business growth.

**Competitive Workforce**

GOAL: Develop recommendations for how New Mexico community colleges and universities prepare our state’s workforce with the advanced skills they need to participate in a highly competitive economy.

**Tech Transfer**

GOAL: Develop recommendations for how New Mexico’s technology resources find ways to expedite the transfer of commercialized technology to the private sector, and New Mexico technology entrepreneurs find the support they need to bring this technology to market.

**Emerging Opportunities**

GOAL: Develop recommendations for how New Mexico diversifies its economy by attracting emerging technology businesses in several technology clusters including aerospace, bioscience and health, energy/environment/water, information technology, and nanotechnology. The Arrowhead Center developed background information on three of these clusters, which is included in this report.

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**NM Employment by Industry Sector, August 2012**

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>13,200</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>21,400</td>
</tr>
<tr>
<td>Transportation, Warehousing &amp; Utilities</td>
<td>21,800</td>
</tr>
<tr>
<td>Mining and Logging</td>
<td>22,700</td>
</tr>
<tr>
<td>Other Services, except public administration</td>
<td>25,900</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>30,900</td>
</tr>
<tr>
<td>Federal Government</td>
<td>31,400</td>
</tr>
<tr>
<td>Financial Activities</td>
<td>32,200</td>
</tr>
<tr>
<td>Construction</td>
<td>41,800</td>
</tr>
<tr>
<td>Government, State</td>
<td>89,000</td>
</tr>
<tr>
<td>Leisure and Hospitality</td>
<td>90,400</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>95,700</td>
</tr>
<tr>
<td>Professional and Technical Services</td>
<td>98,800</td>
</tr>
<tr>
<td>Government, Local</td>
<td>124,900</td>
</tr>
<tr>
<td>Educational Services</td>
<td>0</td>
</tr>
</tbody>
</table>

**SOURCE:** NM Department of Workforce Solutions. Note: Because the national laboratories are managed by private contractors, their combined employees and contractors (about 20,000) are reflected under professional and technical services, construction, and other industries instead of federal government.
Tax Policy, Regulatory Policy, and Infrastructure

STRUCTURAL BARRIERS

Tax policy, regulatory policy, and infrastructure are often regarded as structural barriers to economic growth and are considered essential parts of a state’s business climate. However, researchers agree that there is no one business climate that meets the needs of all employers. Different types of companies, in different regions of the state, bring very different business needs.

The questions people might ask are numerous. Are state tax rates competitive with those in other states? Are current tax incentives sufficient to attract businesses from other states? Is the regulatory burden too great to encourage business start-ups? Does the regulatory burden discourage firms from elsewhere to move their operations to the state? Do existing regulations adequately protect the public and environment? Is public infrastructure, particularly transportation and communications, modern and efficient enough to attract firms and encourage the growth of existing firms? There are no easy answers to these questions.

Tax Policy

Taxes are another structural issue that affects the business climate. Depending on the industry, it may be difficult to determine if tax incentives are adequate or if they need to be enhanced. Effective tax rates (the tax rate actually paid by a firm) are often industry specific. In New Mexico and many other states, firms engaged in natural resource extraction pay taxes (severance taxes, resource conservation taxes, etc.) that firms in other industries do not pay. Firms in capital intensive industries such as manufacturing may be able to take advantage of tax incentives that would not normally be available to firms that specialize in the service sector.

In addition, there has been little research on whether the structure of state taxes (as opposed to the level of tax rates or taxes) encourages or discourages economic activity. It is not easy to calculate the revenue growth implications in a state if it relies heavily on a particular tax type when its neighboring states have a more diversified tax revenue base.

Finally, when a state changes its tax rates or tax incentives, it must examine the costs and benefits before doing so. The costs and benefits include current and future tax revenue as well as economic growth.

Regulation

Government regulation is an often controversial subject. Some people point to the benefits of regulation, in terms of environmental protection, health and safety, or ensuring effective use of public funds. Others argue that regulations are costly for businesses, especially small business. Federal data indicates that few job losses (.3% in 2010) are attributed to “government regulations or interventions.” Most people agree that striking the right balance with government regulation is a difficult – but important – challenge.

Regulations affect existing businesses, start-ups, and businesses considering relocation. In any given state, including New Mexico, there are thousands of business regulations. For example, doctors and other healthcare practitioners must be licensed.

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17 (California Public Policy Institute 1999)
18 (Chicago Tribune 2012)
Eating and drinking establishments are inspected and certified by the state to meet minimum health and sanitary standards. Utilities and insurance companies are highly regulated. Indeed, all businesses are affected by regulations of one kind or another.

### Rankings

Measuring the effects of state taxes and regulations on economic growth is very difficult but there have been attempts to do so at federal and state levels. Some indicators measure taxation, others regulation, others workforce. For this report, we selected four indicators that, together address a number of factors.

#### CHIEF EXECUTIVE

The *Chief Executive* ranking surveyed 550 CEOs on the best and worst states in which to do business. It considered taxes, regulation, workforce, and quality of life.\(^{20}\)

| Chief Executive: Rankings of Best States for Business, 2011 |
|-----------------|--------------|
| **STATE**       | **RANKING**  |
| AZ              | 13           |
| CO              | 12           |
| NM              | 32           |
| TX              | 1            |
| UT              | 9            |

#### ERNST AND YOUNG

(First Study-National Focus)\(^{21}\)

A study by Ernst and Young, in cooperation with the Council on State Taxation, focused exclusively on state and local business taxation. It concluded that New Mexico has the greatest state and local business tax burden of any state.\(^{21}\)

#### Ernst & Young: Overall Business Tax Competitiveness Index (#1 the Best)

<table>
<thead>
<tr>
<th>STATE</th>
<th>RANKING (of 50 states plus DC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ</td>
<td>#39</td>
</tr>
<tr>
<td>CO</td>
<td>#18</td>
</tr>
<tr>
<td>NM</td>
<td>#51</td>
</tr>
<tr>
<td>UT</td>
<td>#17</td>
</tr>
</tbody>
</table>

#### ERNST AND YOUNG

(Second Study-New Mexico Focus)\(^{22}\)

After Ernst and Young released the study above, the New Mexico Tax Research Institute engaged the firm to assess competitiveness if current state tax incentives were analyzed. Ernst and Young compared eight states with New Mexico (Arizona, California, Colorado, Nevada, Oklahoma, Oregon, Texas, and Utah). The study determined that after incentives were accounted for, New Mexico’s ranking improved significantly, in some cases to the most competitive of all states modeled.\(^{23}\)

<table>
<thead>
<tr>
<th>Ernst &amp; Young: Competitiveness by Industry with Incentives, of 9 Comparable Western States (#1 the best)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDUSTRY</td>
</tr>
<tr>
<td>Headquarters</td>
</tr>
<tr>
<td>Research and Development</td>
</tr>
<tr>
<td>Renewable Energy Equipment Mfg.</td>
</tr>
<tr>
<td>Business Support Services</td>
</tr>
<tr>
<td>Food Products Mfg.</td>
</tr>
<tr>
<td>Computer, Electronics Mfg.</td>
</tr>
<tr>
<td>Electrical Equipment Mfg.</td>
</tr>
<tr>
<td>Aerospace Product Mfg.</td>
</tr>
<tr>
<td>Management, Scientific, &amp; Tech Consulting</td>
</tr>
</tbody>
</table>

\(^{20}\) In the actual E&Y reports, the researchers reported their rankings differently. In the first study, 1 was best; in the second study, 1 was worst. This inconsistency has been a common source of confusion, so for this report, we made the numbering consistent with 1 indicating the best in both studies.

\(^{21}\) Ernst & Young, Council on State Taxation 2011

\(^{22}\) Ernst and Young, NM Tax Research Institute 2012
**MERCATUS CENTER RANKING**

One ranking by George Mason University’s Mercatus Center focused strictly on regulatory structures in all states. Its analysis was based on labor regulation, health coverage mandates, occupational licensing, eminent domain, tort system, land-use regulation, and utilities. This study ranked placed New Mexico 41.

**Regulatory Review**

According to the Arrowhead Center, a comprehensive and systematic review of all regulations in New Mexico is probably not a viable policy option. Such a review would be expensive and would take years to complete. A review of a limited number of specific state regulations that might inhibit New Mexico economic activity might warrant consideration, however.

In 2011, shortly after taking office, Governor Susana Martinez signed an executive order creating the Small Business-Friendly Task Force to review rules and regulations and recommend red tape cuts. The effort resulted in reforms in permitting and the procurement process as well as the creation of the Office of Business Advocacy.

Similar efforts are underway in other states. For example, in Kansas, the state created the Office of the Repealer, which was charged with accepting suggestions for repeal of statutes, regulations, and executive orders received from citizens, businesses and government agencies for review and possible repeal.

Going forward in New Mexico, questions for evaluating a particular regulation include the following:

1. Does the regulation have a clearly stated purpose?
2. Is the purpose of the regulation worthwhile?
3. If enforced, does the regulation achieve the purpose?
4. Do the costs of compliance and enforcement exceed the benefits of the regulation?
5. What are the effects of the regulation on economic growth?
6. Is the regulation enforced consistently?
7. Does the regulation contradict or interfere with the intent or enforcement of other laws and regulations?
8. Is the enforcement of the regulation efficient and timely?

**Public Infrastructure**

Public infrastructure, particularly transportation, water, and communications infrastructure, facilitates economic growth and encourages business activity. Infrastructure projects are also significant drivers of state and local economic growth because such projects have relatively large economic multipliers. Public infrastructure investments are made by local, state, and federal agencies, all of which have budget constraints.

A cursory assessment of New Mexico’s public infrastructure suggests that the Rio Grande corridor from Los Alamos to Las Cruces has modern transportation and communications infrastructure. Albuquerque has a major airport serving both personal and business needs. Surface transportation facilities are also modern and efficient in the corridor and, for the most part along I-10 and I-25.

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24 (George Mason University 2011)
25 (Peach 2012)
26 (Peach 2012)
27 (Peach 2012)
BROADBAND
Broadband access is critical to the development of modern businesses. New Mexico’s size and rural nature are major barriers to widespread broadband access. “There are areas in the northeastern section of the state that do not even have a dial-up connection to the internet. Others in that area have internet access, but it is via satellite, which is not very affordable or reliable, or DSL, which is not very fast,” explained Tim Armor, New Mexico Economic Development District (interviewed for a related report). “There is no statewide strategy for building the backbone of a network throughout New Mexico,” Armor explained. “Thus far it is being done piecemeal.”

This “piecemeal” solution adds to another challenge: the process of obtaining rights of way permissions to lay new fiber. “Each federal and state organization, such as the Forest Service or Department of Transportation, has different processes and forms in order to build-out broadband wire on their land,” said Armor. “Further, each of the pueblos and tribes in New Mexico are their own sovereign nation, with their own contacts, processes and forms.”

Armor, who also directs the community broadband network RediNet, said that physical infrastructure is an issue as well. “Once we did get access to run cable along existing infrastructure, we found that we had to spend more of our resources on replacing poles than we’d initially estimated. The current infrastructure in the United States, like electrical poles, is old and needs maintenance and sometimes replacement.”

Potential Next Steps
Annually, several state agencies and private sector organizations sponsor the annual New Mexico Infrastructure Finance Conference. The 2011 conference produced a whitepaper with suggestions on streamlining the infrastructure process. Three of their suggestions follow:

1. Create a single capital outlay funding application.
2. Ensure greater coordination among the various entities requesting capital outlay funds.
3. Establish a statewide GIS database containing specific project information.

Another idea offered by the Arrowhead Center is to evaluate potential public infrastructure projects based on their long-term implications for state economic growth. For example, until recently, the wastewater system in Santa Teresa, NM was seriously out of date. As a result, a major employer in the area, TE Connectivity, planned to move its operations elsewhere. In 2011, New Mexico announced it would invest capital outlay dollars to improve Santa Teresa’s water system. As a result, TE Connectivity not only kept their 80 existing employees in New Mexico but also brought in another 100 jobs from Texas and expects to bring in more in the future.
TECHNOLOGY TRANSFER

Technology Transfer is defined as “the process by which technology or knowledge developed in one place or for one purpose is applied and used in another.”35 This usually refers to technology transfers from federal laboratories, private industry laboratories, academia, federal agencies, and state and local governments. The process of transference enables technological developments to be commercialized into new products, processes, applications, materials, or services to fulfill public and private needs.

New Mexico Resources

New Mexico has a burgeoning technology transfer sector with many organizations dedicated to commercializing excellent and innovative technologies. These research centers include Los Alamos National Laboratory, Sandia National Laboratories, University of New Mexico, New Mexico State University, New Mexico Tech, Sandia Science and Technology Park, University of New Mexico Science and Technology Park, Technology Ventures Corporation, the Santa Fe Institute, and the Air Force Research Laboratory Space Vehicles Directorate.

Los Alamos National Laboratory’s main mission is nuclear deterrence, but it conducts research in space systems, intelligence analysis, cyber security, counterterrorism and other areas. Los Alamos pursues efforts to license its technologies to industry and start-up companies. Los Alamos also has industry partnerships with corporations such as Procter & Gamble and Chevron. It is estimated that Los Alamos provides a $2.9 billion impact to the state’s economy and supports about 24,000 jobs, according to a University of New Mexico study in 2011.

Sandia National Laboratories licenses and transfers technologies in: bioscience; computers and information science; defense systems; energy and environment; homeland security; materials chemistry, and nanoscience; and microelectronics, sensors, and photonics. In 2010, Sandia provided nearly $2.4 million in technical assistance for 194 New Mexico small businesses in 22 counties.36

STC.UNM at the University of New Mexico collaborates with the national laboratories in Los Alamos and Sandia and coordinates all technology transfer activities at UNM. Technologies developed at the university, especially in life sciences and physical sciences, can be licensed by companies or spun off into start-up technology firms at STC.UNM. “STC (Science and Technology Corporation) works with inventors, entrepreneurs, investors, and other constituents to assist in the formation of start-up companies based on UNM technologies. The creation of startup companies can provide jobs for the community and assist in moving technologies to the marketplace.”37 In fiscal year 2011, UNM made $3.1 million in licensing revenue, ranking it in 61st place out of 153 research universities.38

The University of New Mexico Science and Technology Park works closely with STC.UNM and provides 360,000 feet of office space on 163 acres in Albuquerque. Tenants pursue technology-oriented activities in microelectronics, photonics, optoelectronics, advanced materials, manufacturing technology, and medical devices.

36 2011 Sandia National Laboratories Economic Impact Report
37 https://stc.unm.edu/entrepreneurs/

35 www.federallabs.org
New Mexico State University Arrowhead Center manages a 200-plus acre business and research park in Las Cruces. It brings together faculty, students, staff, entrepreneurs, and public-private partnerships to promote new business development from technologies developed at NMSU. The Arrowhead Center and the NMSU Office of Intellectual Property and Technology Transfer specialize in engineering, chemistry, agriculture, environmental sciences, and national security technologies.

New Mexico Tech has more than a “dozen research divisions that work with private industry, government agencies, and other universities.” These research divisions provide subject matter expertise and technology development in petroleum, computer security and forensics, explosives and terrorism response, seismology, optical telescopes, genome resources, biology and earth sciences, and atmospheric research.

Sandia Science and Technology Park has 33 companies in 23 buildings and more than 2,000 employees at its 340-acre Albuquerque campus. It was recognized by the Association of Research Parks as the 2008 Outstanding Research Park of the Year. Companies focus on chemical, computer, and electronic manufacturing. Most other firms are professional, scientific, and technical service providers.

Technology Ventures Corporation assists start-up companies with financing and consulting for technology transfer from national laboratories and universities that ultimately enables entrepreneurs and investors to accelerate economic growth. TVC co-founded the Sandia Science and Technology Park. It also publishes the magazine Innovation: America’s Journal of Technology Commercialization.

The Santa Fe Institute is a think tank and research institute founded in 1984 by former scientists at Los Alamos National Laboratory that focuses on innovative quantitative methods to study cities, scaling and sustainability; decision making and cognitive systems; multiple scales of conflict; and risks, markets, and innovation.

The Air Force Research Laboratory Space Vehicles Directorate at Kirtland Air Force Base has three divisions. The Spacecraft Technology Division develops next-generation spacecraft payload electronics and avionics. The Integrated Experiments and Evaluation Division conducts ground, space, and near space experiments. The Battlespace Environment Division explores environmental impacts to space systems and operations.

Global Research and Development
The National Science Foundation published Science and Technology Indicators 2012 earlier this year. This analysis presents a cautionary picture for future funding of research and development. Globally, research and development (R&D) expenditures have been rising, averaging 7% annually over the last 10 years, and reaching an estimated $1.3 billion (in purchasing power parity) in 2009. The U.S. accounts for about 31% of the global total, down from 38% in 1999.

Asia represented 24% of the global R&D total in 1999 but accounted for 32% in 2009, including China (12%) and Japan (11%). The main source of the majority of Asian growth over the past 10 years is China where overall R&D has increased approximately 20% per year. South Korea has averaged nearly 10% growth over the same period.

39 http://www.nmt.edu/research-emphases-at-new-mexico-tech
Overview of U.S. Research and Development

Overall R&D performed in the U.S. in 2009 totaled an estimated $400 billion (current dollars). When adjusted for inflation, the 2009 estimate represents a $6 billion or 1.7% decline from 2008. Contrary to recent trends, U.S. R&D performance has continually increased since 1953. From 2004 to 2009, annual growth in U.S. R&D spending averaged 5.8% compared to the annual average growth of 3.3% for gross domestic product (GDP). Over the last several decades, average annual growth in R&D spending has substantially outpaced that of GDP.

The rate of R&D intensity, measured by the ratio of R&D to gross domestic product, is also a measure of technology-based competition. The U.S. ratio was about 2.9% in 2009, fluctuating between 2.6% and 2.8% during the prior decade. In 2009, the U.S. ranked eighth globally in R&D intensity—surpassed by Israel, Sweden, Finland, Japan, South Korea, Switzerland and Taiwan.

The private sector conducts and funds most R&D in the U.S. The business sector funded an estimated $247 billion, or 62% of the U.S. total in 2009. The federal government is the second largest funder of U.S. R&D, providing an estimated $124 billion, or 31% of the U.S. total in 2009. Even with a decline in 2009, expanded business spending has accounted for most of the nation’s R&D growth over the last five years. The academic sector is the third largest performer of R&D, accounting for an estimated $54 billion in 2009, or about 14% of the national total.

Potential Next Steps

The Arrowhead Center developed recommendations for potential public and private sector activities.

1. **Enhance and increase the numbers of entrepreneurs.**
   a. Speed up commercialization of innovations from universities.
   b. Create private and affordable health insurance options for entrepreneurs.
   c. Cut back on occupational licensing requirements.
   d. Expand entrepreneurial education in secondary and post-secondary schools.

2. **Facilitate launch of new ventures.**
   a. Reduce administrative burdens required for starting a new businesses.
   b. Embrace digital firm startups.
   c. Implement land-use reform.
   d. Encourage STEM (K-12) education.

3. **Facilitate growth of new ventures.**
   a. Examine policy on non-compete enforcement.
   b. Permit credit unions to make limited equity investments in startups.
   c. Simplify and reduce corporate taxes.
   d. Encourage entrepreneurship finance programs.

4. **Foster culture of entrepreneurship.**
   a. Pay for immigrant visas.
   b. Foster networks of serial entrepreneurs and investors.
   c. Promote and celebrate entrepreneurs.
   d. Measure entrepreneurial success.

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**National R&D Facts**

- The private sector funds most R&D in the U.S., followed by government and academic sectors.
- The U.S. ranks behind Israel, Sweden, and several Asian nations in R&D intensity.
- Overall R&D in the U.S. totals about $400 billion.
WORKFORCE DEVELOPMENT

Essential goals of workforce development are to prepare current and future job-seekers and entrepreneurs for the modern workplace, and ensure that businesses have access to the employee-base they need. Workforce development includes a wide range of activities, policies, and programs to support a viable workforce for current and future business and industry.40

Workforce development efforts can be designed to benefit the individual, a particular firm, an industry sector, or the long-term interests of society. Workforce needs change frequently. Modern economies are increasingly driven by rapid technological change and globalization. In this environment, some occupations disappear and entirely new industries become important parts of the economy. Everyone must adapt. A highly skilled and well-trained worker who entered the labor market a few years ago may be ill equipped for the jobs of today – or the jobs of the future. That worker is highly likely to change jobs and career fields multiple times. (One government study of younger baby boomers found they held an average of 11 different jobs by the age of mid-40s.)41

Employer Needs

Employer needs are also diverse. High tech industries often require a substantial portion of their employees to have advanced degrees or specialized training. Workers with STEM (science, technology, engineering and mathematics) degrees are in high demand nationally and in New Mexico, but recent research indicates that many people with STEM degrees work in non-stem occupations and many workers in STEM occupations do not hold

CASE STUDY:
Denver Workforce Analysis

The City and County of Denver conducted a regional analysis of its workforce and identified six key insights in their area:1

1. Businesses needed an increased understanding of workforce services; companies would use existing programs if they were promoted and marketed.
2. Businesses needed a service to better connect them with potential candidates.
3. Industry would use training programs that would help teach core skills (such as writing), especially if the programs had flexible schedules or were conducted at a business location.
4. Financial support for training programs would encourage businesses to take advantage of them more often.
5. Language skills, including Spanish, were judged important for every industry. Businesses wanted training for employees who were not fluent in English as well as foreign language training for English-speakers
6. The incoming workforce was not considered prepared for the working world. Educational institutions were called on to prepare youth for the business world through more hands-on experience, practical knowledge, and basic skills.

40 (Haralson 2010)
41 (Bureau of Labor Statistics 2012)
STEM degrees. Labor market projections suggest that only about a third of New Mexico job openings over the next decade will require post-secondary education.

Employers increasingly emphasize the importance of soft skills and the lack of such skills among potential workers. Soft skills include professionalism or work ethic, oral and written communication, teamwork and collaboration skills, critical thinking or problem-solving skills. Soft skills can be as simple as showing up for work on time on a regular basis or treating fellow workers and customers with courtesy and politeness. Employers increasingly consider soft skills as important, or may be even more important, than technical skills. How to provide soft skills training remains a significant challenge.

New Mexico Activities

New Mexico is very active in the workforce development arena. There are more programs available than can be listed here. The Department of Workforce Solutions administers many programs, some of which include:

- “One-stop shops” throughout the state that aim to provide both workers and employers access to the employment services they need
- The annual State of New Mexico Workforce Report containing an update on labor market conditions and projections of labor force supply and demand for industries and occupations
- Development of New Mexico’s Workforce Strategic Plan with detailed descriptions of existing programs and activities as well as future directions and needs

In addition to DWS, several other agencies and organizations are active in workforce development. The New Mexico Economic Development Department administers the Job Training Incentive Program (JITP), which provides funding for classroom and on-the-job training for newly created jobs in expanding or relocating industries. The K-12 public schools, community colleges, and four-year institutions of higher education are also very active in workforce development.

Governor Martinez recently established the Employability Partnership of New Mexico consisting of cabinet secretaries and business leaders. The goal of the Employability Partnership is to provide “recommendations about how to improve the workforce delivery system, eliminate duplication of services and maximize funding at the agency level to improve the return on investment.”

Alignment

One clearly identified priority in the DWS’s Workforce Strategic Plan is better alignment of workforce development programs with economic development strategies. According to the plan, “There is a disconnect between workforce development and economic development efforts resulting in little or no alignment of workforce and economic development strategies.” A similar concern was raised at New Mexico First’s Centennial Town Hall in spring 2012.

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42 (U.S. Department of Commerce 2011)
43 (Peach 2012)
44 (Schwabel 2012)
45 (New Mexico Department of Workforce Solutions n.d.)
46 (New Mexico Department of Workforce Solutions 2012)
47 (New Mexico Department of Workforce Solutions 2012)
48 (New Mexico Economic Development Department n.d.)
49 (New Mexico Department of Workforce Solutions 2012, p. 28)
50 (New Mexico First 2012)
Other identified needs include better alignment of workforce programs with educational institutions, a common database to facilitate workforce training delivery systems, more active public-private partnerships, as well as apprenticeship and mentoring programs.

Potential Next Steps
In researching this report, the Arrowhead Center suggested that the upcoming summit might offer direction in the following areas:

- Specific and general improvements in the state’s workforce development efforts
- Revisions to current workforce programs
- Suggestions for entirely new programs
- Recommendations on how to deliver workforce training more efficiently
- Development of more and better public-private sector collaborations
- Approaches to better align economic development and workforce strategies
Emerging Opportunities

ENERGY, ENVIRONMENT, WATER

In New Mexico, energy is a key driver of the state’s economy. Environment and water, however, are rarely viewed as economic issues. In this report section, the Arrowhead Center explores emerging economic opportunities linking energy, environment, and water.

Fossil and Renewable Fuels

When drilling for fossil fuels, more water than fuel is extracted from the ground. The growth and sustainability of the energy sector is tied to environmental issues and is dependent on predictable supplies of water.

In the area of renewable alternative energy, New Mexico has enormous opportunities to develop solar energy, algae-based biofuels, and "Green Grid" technologies. Greater emphasis must be placed on shortening the time from the testing to production stage and investing in high-potential commercial technologies if the state is to compete on a national level with a broader mix of energy sources.

Congressional Report

The energy-water nexus has been of concern for a while. Late in 2004, the Secretary of Energy was asked by Congress for a “report to Congress on the interdependency of energy and water focusing on threats to national energy production resulting from limited water supplies, utilizing where possible the multi-laboratory Energy-Water Nexus Committee.”

The committee included representatives from 12 Department of Energy national laboratories, with principle responsibility falling to the National Energy Technology Laboratory, Los Alamos National Laboratory, and Sandia National Laboratories. The Committee’s final report was submitted to Congress in late 2006. (Sandia still maintains a website devoted to the issue: www.sandia.gov/energy-water/.)

National defense, food production, human health, manufacturing, recreation, tourism, and the daily functioning of households rely on abundant, accessible, “cheap” energy, water, or both, according to the report. It is becoming a challenge to keep them in balance. Energy production requires water, which as we know in New Mexico, already is in short supply. Second in use only to agriculture, energy production from fossil fuels account for 39% of all freshwater withdrawals in the U.S. Of that, 71% goes to fossil fuel electricity generation. Coal, accounting for 52% of electricity generation, withdraws 25 gallons for each kilowatt hour of electricity generated. As the authors of the Congressional report pointed out, citizens may indirectly use as much water turning on the lights and running electric appliances each day as they do taking showers and watering lawns.

Several trends suggest that the situation will worsen, creating a need for new solutions.

- General population and economic growth will require 393,000 megawatts of generating capacity by 2020, with a corresponding consumption of water.
- Population growth is greatest in the southeast and mountain west, areas already suffering severe water shortages.
- Population growth will push food and energy into even greater competition for water.

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51 (U.S. Department of Energy 2006)
• The energy costs of treating and transporting water accounts for as much as 80% of the delivered price of water.
• Increasing power generation could increase atmospheric carbon that in turn could adversely affect the amount of water needed to produce electricity.

The report recommended a three-point agenda to Congress:

1) **Prediction and Decision Support**: Create a suite of decision tools to predict energy impacts on water quality and quantity; forecast water and energy supply and demand on a regional basis; and identify trouble spots by analyzing "what if" scenarios.

2) **Science and Technological Innovation**: Innovations could be directed at:
   a) Treating and reusing non-potable process ("gray") water in power production
   b) Accessing currently unused water sources, such as saline aquifers
   c) Reducing or eliminating water use altogether in generating power
   d) Delivering water and energy more efficiently to prevent losses
   e) Minimizing water-related impacts from mining, energy production and use, and disposal of solid byproducts

3) **Implementation and Technology Transfer**: Key to success will be the early formation of stakeholder teams that can provide real-world feedback, test the decision support systems, create prototypes for technological innovations, and implement solutions quickly. These teams will include: national laboratories and universities that conduct research and development; state and federal agencies responsible for water, energy, and environmental management; and industries and consortia involved in the production and/or distribution of water and energy.

**New Mexico Research**

New Mexico recently considered the water-energy-environment in a separate initiative and the broader context of the green economy generally. Solutions to the challenges were published in *Growing New Mexico’s Clean Tech Economy: Strategies to Strengthen Technology Commercialization* and were not too far removed from those proposed by the federal Energy-Water Nexus Commission.52

The report was drafted by an ad hoc working group. Meeting between March and September 2010, the group included the three New Mexico research universities, federal laboratories, venture capitalists, serial entrepreneurs, and other economic development professionals. The group concluded that New Mexico does not lack for relevant research and development capabilities in dealing with pressing national and state issues, but that it was limited by obstacles to entrepreneurial solutions. To address these issues, the working group made four recommendations.

1. **Coordinate**: Improve statewide coordination, promotion, evaluation and monitoring, and technology commercialization.

2. **Incentivize research institutions**: Expand incentives to stimulate technology commercialization and industry engagement at our research institutions.
   a. Legislatively create a state matching fund for technology maturation and provide recurring funding.
   b. Legislatively expand the New Mexico Small Business Assistance Program.

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52 (New Mexico Economic Development Department 2010)
c. Work with university administrations and faculty to evaluate and incentivize industry-funded research and develop Proof of Concept centers.
d. Amend the law authorizing state Research and Public Service Program (RPSP) funds to require that 10% of these funds go to support technology commercialization activities in state-identified priority areas.
e. Coordinate education and workforce programs with these economic development goals and policies.

3. **Use incentives wisely:** Strengthen incentives to attract angel, venture capital and business R&D investments. Retain existing incentives and programs.
   a. Improve the Angel Investment Tax Credit (AITC) and remove its sunset provision
   b. Reenact an improved Research and Development Tax Credit
   c. Retain and expand existing State Investment Council New Mexico targeted programs
   d. Defer taxes from the sale of ownership in a startup if that money is reinvested in another New Mexico startup within 2 years

4. **Grow the tech market:** Cultivate the market for targeted technology products in New Mexico.
Emerging Opportunity
AEROSPACE

In New Mexico, aerospace technology offers potential for job and revenue creation. In this report section, the Arrowhead Center explores emerging economic opportunities in this arena.

Aerospace has been and remains a mainstay of the U.S. economy. In recognition of last month’s National Aerospace Week, the National Aerospace Industry Association published the following Facts to Know.53

- Aerospace and defense provides more than 1 million direct high-paying middle class jobs.
- The average salary of an aerospace and defense worker is $80,175. The national average is $44,410.
- The aerospace and defense industry contributes 2.3% to the nation’s GDP. The estimated federal and state employee wage and corporate cash income taxes paid by the aerospace and defense industry and employees totaled $38 billion. This does not include taxes paid by indirect employees or sales and other taxes.
- If sequestration as detailed in the Budget Control Act goes into effect, more than one million jobs could be at risk. The job loss to the aerospace/defense and supply chain could total 352,000.
- The final shuttle flight launched July 8 ended an era for American space flight. There is a new path forward in space, focused on development of greater commercial capabilities and development of exploration elements including a long-duration space capsule and a heavy lift launch vehicle to enable it to go beyond Low Earth Orbit.

More than half (61%) of the nation’s aerospace industry jobs are located in six states: Washington, California, Texas, Kansas, Connecticut, and Arizona. Several smaller aerospace manufacturing clusters are found in states such as Florida, Georgia, Ohio, Missouri, and Alabama. Other aerospace centers are beginning to emerge in southern states, such as South Carolina, where Boeing is now building a second production line to produce the 787 Dreamliner. New Mexico’s best opportunities may lie in emerging, rather than “traditional” aerospace markets: Unmanned Aerial Systems and Suborbital Reusable Vehicle launches.

Unmanned Aerial Systems

The U.S. unmanned aircraft systems (UAS) market is a quickly growing branch of the aerospace industry. The Department of Defense has deployed UAS to war zones around the world. These systems have received attention for their increased use in Iraq and Afghanistan.

In addition to military UAS operations, a new UAS sector is being driven by non-military government agencies and commercial entities that are interested in the new technology. In February 2012, Congress passed the Federal Aviation Administration’s Modernization and Reform Act, which gave the FAA until 2015 to develop a “comprehensive plan for safely accelerating the integration of civil unmanned aerial vehicles into the national airspace system.”

This civil market is small in comparison to the billions spent annually by the military for unmanned aircraft; however, the potential for future growth of commercial and civilian UAS is substantial. The Teal Group, a defense and aerospace market analyst, expects the global spending on UAS to increase

53 (Aerospace Industries Association 2012)
from $6.6 billion annually to $11.4 billion annually over the next decade.  

The most recognizable component of UAS is the vehicle or airframe. Remotely powered vehicles consist of more than the airframe, however. They include a propulsion system, flight control computer, navigation system, and a sense/avoid system. The latter two components in particular are challenges for expanded deployment in civilian airspace and, thus, opportunities for economic development.

Lacking an on-board pilot, remotely piloted vehicles or drones are relatively constrained in their response to unforeseen obstacles in their flight path. Technical challenges include the limited ability to sense and avoid flight conflicts and problems with navigation systems including its reliance on GPS.

Potential entrepreneurs consider a wide range of opportunities in unmanned aerial systems. In addition to the aircraft, a UAS is comprised of a payload, human element, control element, system platform, display, communication architecture, flight operations and more. UAS payloads include sensors, communication relay, electro-optic/infrared sensors (EO/IR), Synthetic Aperture Radars (SARs), daytime video camera, and cargo. Payloads may be internal or external to the UAS.

ROLE FOR NEW MEXICO WITH UAS

New Mexico provides a superb environmental setting for UAS testing and operations. New Mexico operates the only FAA-approved UAS Flight Test Center of Excellence in the U.S., representing approximately 15,000 square miles of airspace in the National Airspace System. Immediately adjacent the Department of Defense controlled airspace at White Sands Missile Range, New Mexico provides a combined total of 23,000 square miles of potential UAS airspace access. Additionally, New Mexico’s relatively low population density and low traffic density may allow for safe testing and operations applications, particularly as sense and avoid technologies are developed and tested.

New Mexico’s research and development resources, including educational institutions, national laboratories, military installations, and other federal entities position the state to offer the FAA an assortment of benefits. The state has three university research institutions, each with established links to the UAS industry:

- New Mexico State University’s Physical Science Laboratory specializes in 21st Century Aerospace and Information Systems and Security Systems; it also includes the UAS Technical Analysis and Applications Center.
- The University of New Mexico has been involved in a number of UAS-focused research projects, including work on cooperative UAS networks and control systems of small scale UAS.
- New Mexico Tech supports UAS research on topics such as algorithms for UAS control and navigational systems.

Federal laboratories are actively involved as well. LANL is engaged in UAS-specific research through groups such as its UAV Damage Prognosis and Reliability Institute, a division of its National Security Education Center. Sandia has undertaken a variety of UAS-related research, such as radar systems for UAS reconnaissance and cooperative monitoring. In addition, both laboratories address aspects of emergency response and protection of critical infrastructure using airborne platforms.

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54 (Teal Group Corporation 2011)
**Spaceport America**

Spaceport America is the world’s first purpose-built, commercial spaceport, designed to “enable affordable, efficient, and effective space access and unlock the potential of space for everyone.” According to Spaceport America, after 15 years of studies that began in the early 1990s started to get traction in 2004 when the state submitted the winning bid to host the X Prize Cup. In 2005, Virgin Galactic located its world headquarters in New Mexico. In 2006, UP Aerospace Corporation launched the first vehicle from Spaceport America. The Federal Aviation Administration awarded the New Mexico Spaceport Authority a launch license for vertical launch activity in 2008, followed by the construction groundbreaking at Spaceport America in 2009. This year, Armadillo Aerospace launched four flights from the facility. The economic development opportunities associated with the spaceport are somewhat unclear now but have potential.

**Suborbital Reusable Vehicles**

On August 1, 2012, the Tauri Group released its report on Suborbital Reusable Vehicles: A 10-year Forecast of Market Demand. Forecasts are based on estimates and are thus speculative.

The suborbital reusable vehicle (SRV) market is comprised of eight segments: commercial passenger, commercial cargo, research, aerospace technology test and development, education, media and public relations, remote sensing, and point-to-point transportation. In a baseline scenario on current trends and consumer interest, Tauri predicted total demand over ten years would exceed $600 million in revenue and support daily flight activity. In a more optimistic growth scenario, SRV flight revenue could exceed $1.6 billion over a ten-year period.

**Potential Next Steps**

Driving economic growth in aerospace requires a statewide clearinghouse for aerospace technology development that also provides a mechanism for private aerospace companies to participate in and gain access to funded research. The absence of a mature, full spectrum aerospace engineering department in the state is a weakness that must be addressed. Without the appropriate education and training of students, professionals and technicians, the state will not be able to convince medium-to-large sized aerospace businesses to locate to New Mexico and remain here. In addition, New Mexico has a great opportunity to capitalize on Spaceport America, which can be a platform for innovation.

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55 (Spaceport America n.d.)
56 (Spaceport America n.d.)
57 (Teal Group 2012)
58 (Space Safety Magazine 2012)
Emerging Opportunity

BIOECONOMY

New Mexico has world-class capabilities in bioscience and biotechnology that could serve as the basis for increased economic growth. In this report section, the Arrowhead Center explores emerging opportunities in the bioeconomy.

Bioeconomy refers to economic activity focused on biotechnology, such as biofuels, genomics, neuroscience, health research, and development of diagnostics and sensors. Biotechnology has seen rapid growth in New Mexico and is a prime source of high-tech economic development. If growth is to continue in this arena, further investments may be needed to provide an even broader base of bioscience jobs in bioenergy, human health, animal health, and agriculture.

New Biology

In July 2008, the National Research Council examined the current study of biological research and how best to capitalize on its advances. The council defined “New Biology” as the integration of biology with physics, chemistry, computer science, engineering, and mathematics. New Biology was seen as addressing some of society’s most fundamental challenges:

- Food
- Environment
- Energy
- Health

The council proposed a national initiative with collaboration between government, universities, industry, and research laboratories. The council’s report also became the foundation for the White House’s National Bioeconomy Blueprint, which outlines strategic objectives:

1. Invest in research and development that will support the future U.S. bioeconomy.
   a. Expand and develop essential technologies.
   b. Integrate approaches across fields.
   c. Implement improved funding mechanism.
2. Facilitate translation of bio-inventions from lab to market.
   a. Enhance entrepreneurship activities at universities.
   b. Utilize federal procurement authority.
3. Reduce regulatory barriers, increase speed and predictability of regulatory process, and reduce regulatory burden (while protecting human and environmental health).
4. Update training programs and align academic institution incentives with student training for national workforce needs.

Bioeconomy Employment

The biotechnology industry is now segregated into five subsectors:

- Agricultural feedstock and chemicals
- Drugs and pharmaceuticals
- Medical devices and equipment
- Research, testing, and medical laboratories

AUTHOR’S NOTE: People looking for more details on the industry are encouraged to read the entire report cited in the previous footnote. The report objectively compares bioeconomy efforts in states, including New Mexico. See bibliography for complete citation.

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59 (Council 2009)

60 (White House 2012)
61 (Biotechnology Industry Association and Battelle Technology Partnership Practice 2012)
62 AUTHOR’S NOTE: People looking for more details on the industry are encouraged to read the entire report cited in the previous footnote. The report objectively compares bioeconomy efforts in states, including New Mexico. See bibliography for complete citation.
BACKGROUND REPORT: NMEDD’s New Century Economy Summit

• Bioscience-related distribution

Nationally, about 70,000 bioscience companies employed approximately 1.6 million people in 2010. From 2001 through 2007, biosciences employment expanded at nearly twice the rate for private sector jobs generally. Since the economic downturn in 2007, private sector employment generally has declined by approximately 6.9%, but in biosciences only 1.4%.

Employment and job growth are not uniform across the subsectors. Research, testing, and medical laboratories employ more than 450,000 workers, approximately one in three for the entire industry. It has also been the most robust subsector, increasing employment by 23.8% from 2001 – 2010. Bioscience related distribution employs another 440,000 people. It is the only other subsector that saw a net increase in employment between 2001 and 2010 (6%), but suffered a net job loss of 4.2% since 2007. All other subsectors suffered losses over the period from 2001 and since 2007.

After examining the disciplines underlying the New Biology, much depends on workers with advanced degrees, often drawn from national and even international markets. Not surprisingly, then, bioeconomy workers tend to earn higher wages than private sector wages generally. Also not surprisingly, this is of significant interest to federal and state policy makers.

New Mexico’s Bioeconomy

While the national bioeconomy is robust, state comparisons indicate that New Mexico lags except in the area of research, testing, and medical laboratories. Organizations in this subsector are engaged with preclinical drug development, drug delivery systems, diagnostic imaging and testing, stem cell/regenerative research, biomarkers, and research/laboratory support services. New Mexico is one of twelve states with a specialized concentration of jobs in the subsector.

Potential Next Steps

The Biotechnology Industry Association published suggestions for how states can grow their bioeconomies. Education was a key goal: “In this global economy, nearly every competitor has access to big breakthroughs in technology and to the equipment and capital to produce standardized products, but those regions that possess the human capital, with its insights, competencies, and experience will have the competitive advantage.”

More specifically, the industry suggests that policymakers, educators, and business collaborate on four primary strategies:

• Build career pathways for future biosciences talent with constrained budgets. Attract and retain a continuing flow of educated (Ph.D., MS, BS, AA) and technically proficient workers.
• Build a supportive regulatory climate to ensure predictable and stable regulatory treatment of biosciences firms.
• Utilize state dollars for technology-based economic development. Some states offer tax credits, loan funds, or other resources.
• Encourage universities and research centers to continue efforts in technology transfer. See previous chapter on technology transfer.

63 (Biotechnology Industry Association and Battelle Technology Partnership Practice 2012)

64 (Biotechnology Industry Association 2011)
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