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Does a Vibrant Research and Development Enterprise Benefit the Community?

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It is an article of faith accepted throughout the world by both the scientific community and the political establishment that high tech builds economies, provides high quality jobs, engenders higher education and contributes to overall quality of life. R&D investment drives infrastructure improvements, and an educated work force boosts the economy with their high incomes. Their commitment to education, public parks and libraries and a quality environment give politicians the support they need to pass legislation that moves the community toward the greater good. There is an 8 to 1 trickle down effect of job generation, so the whole region enjoys the fruits of the public and private investment in biotechnology, medical technology, nanotechnology, IT and all the other information-rich occupations that advanced industries generate.

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At least this is the mantra which is repeated on such a continuing basis that it is accepted as unquestionable wisdom, brought down on granite tablets from the mountain top.

There's a lot of data to support this notion, as well as lots of anecdotal evidence in its favor. Consider Boston, San Diego and San Francisco; where all these dreams of local politicians are fulfilled. On an international level, one need only take note of Sweden, Israel and Switzerland among countries that pour money into high tech through both the private and public sectors to see how this model of economic development has paid off lavishly.

But what if this model is not accurate? What if it confuses cause and effect, and advanced technology enterprises find their homes in regions that already have all of these high quality environment advantages? What if this constant promotion of high tech development all just hype, and the investments that governments pour into construction of advanced technology communities really have little effect on the overall development of a viable, sound economy? If this were true then we could expect that there would be regions that received huge largesse, where the high tech community is lavishly supported, yet have precious little to show for it outside the gates of the citadel.

And that's exactly what I'm going to show you.

Welcome to the State of New Mexico, where expenditures for R&D are the highest of any political region in the whole world, yet the state struggles valiantly to find its place at the bottom of every national economic indicator.

For the last 60 years the federal government and the private sector have supported two massive R&D institutions in New Mexico, the Los Alamos National Laboratory and the Sandia National Laboratory. The placement of these facilities goes back to a whim of J. Robert Oppenheimer, the first Director of the Los Alamos Laboratory, who recommended it to the Roosevelt administration back in the 1940s as an isolated, secure location where brilliant minds could focus on the birthing of an entirely new approach to warfare.

Today Los Alamos is a United States Department of Energy (DOE) national laboratory, one of the largest multidisciplinary institutions in the world. It is the largest institution and the largest employer in northern New Mexico with was \$27,644 in 2005, fourth from the bottom.

approximately 16 thousand full time and contractual workers.

The staff is distinguished and highly trained. According to Wikipedia, one-third of the laboratory's technical staff members are physicists, one-fourth are engineers, one-sixth are chemists and materials scientists, and the remainder work in mathematics and computational science, biological science, geoscience, and other disciplines. Los Alamos has close ties with universities and industry in both basic and applied research. The annual budget is baronial, weighting in at approximately \$2.2 billion.

Sandia National Laboratory is the other leg of the massive New Mexico R&D presence. Managed and operated by the Sandia Corporation (a subsidiary of Lockheed Martin Corporation), its budget is an equally lavish \$2.2 billion for 2006. It consists of two operations, one in Albuquerque, and the other in Livermore, California. Its principle R&D mission is to develop, engineer, and test the non-nuclear components of nuclear weapons. It is one of the prime United States Department of Energy national laboratories. Its 4.4 square mile secured campus is located on Kirtland Air Force Base.

If New Mexico were a country, it would be the most R&D-intensive in the whole world, with a contribution of 8.73% of GDP from R&D, out of a total gross state product of \$75.9 billion. This puts it way ahead of such research power houses as Israel (4.9%), Sweden (4.27%) and Japan (3.15%).

Yet for all this infusion of funds, the results over more than a half century have been, in a word, pathetic. The present day statistics on the state are a litany of woe, with New Mexico at or near the bottom of all the positive indicators and a

According to the CDC, in 2004 New Mexico was 43rd in number of “unhealthy days”, 48th in terms of load of mental distress, 35th in level of oral health and 39th in amount of disability (in each of the categories, the lower the ranking, the more negative the standing).

In terms of crime, New Mexico is a big winner. In the year 2000 the state had a total Crime Index of 5,518.9 reported incidents per 100,000 people, 3rd highest in the nation. With 7.4 Murders per 100,000 people, New Mexico weights in at number five. In every crime category the state garners recognition among the top 10.

Perhaps most disturbing for this high R&D state is the performance of the public education system, which shows the same dreary level of underachievement. According to the Council of Chief State School Officers, New Mexico was third from the bottom in math proficiency in 2003, and between 1990 and 2002 was dead last in percentage of high school students enrolled in chemistry. Other data from the report follow the same trends.

New Mexico is sparsely populated, with 1.8 million in the entire state (year 2000 statistics) and 16 persons per square mile. But this only tells part of the story, as half this number is situated in metropolitan Albuquerque. Vast regions of the state are a beautiful lonely wilderness of rugged mountains, forests of pinon pine and Douglas fir, red deserts, gorges and canyons. Blue and purple mountain ranges fade away into the endless distance. It is little surprise that the main source of revenue outside the high tech sector is tourism.

Much of New Mexico's failure to build a strong and vibrant society over the years can be blamed on a tragic history of exploitation and ruin that goes back four centuries to the time of the

leader in all the negatives. Per capita income Spanish conquest. In 1598, Don Juan de Onate, a wealthy conquistador from Zacatecas, Mexico, claimed a huge swath of land North of the Rio Grande for Spain, a region that would include all the Puebloan towns of the American Southwest. What followed were 80 years of subjugation, exploitation, rape, pillage and torture of the Navaho, Hopi, Tewa and various other tribes, who finally, in 1680, staged the first, last and only successful rebellion on the part of native Americans against their European overlords. In a spasm of violence the Puebloan peoples rose up together and drove the Spanish out. The survivors spent the next 20 years regrouping in Mexico and returned in force to put down their ungrateful subjects once and for all.

The Spanish occupation of the Southwest established New Mexico as a colonial fiefdom whose hegemony would eventually pass to the Americans. The Anglo domination of New Mexico has been best described in the rich literary traditions of the Southwest, which chronicle the years of poverty, misery and deprivation that have brought the state to its present low standing among its peers within the union.

There is an inability or an unwillingness to connect to the high tech establishment on the part of New Mexico politicians that arises from a long history of running the state as a third world economy, by which tourism and raw materials drive the economy and wealth is recycled through a ruling elite that see no reason to alter the status quo. The high tech sector is left isolated and out of the loop, enjoying their disconnected lives. Of all the school systems in the state, the Los Alamos public school system is like a shining star in a sea of mediocrity, providing the high salaries and quality education that could lift the entire state if it were broadly distributed.

It should be held up as a national scandal that billions and billions of dollars of federal, state and private money have been poured into New Mexico over so many years with so little to show in general benefit to the people and the society. The question of whether the tax payers got their money's worth in terms of armaments and other associated technologies cannot be answered, but clearly this vast expenditure of resources should have produced the jobs, the schools, the infrastructure, the high quality of life that its congressional promoters promised. It seems that the federal largesse spread over New Mexico was a philosophy of guns and butter with all guns and no butter.

There are many counter arguments to this gloomy presentation of New Mexican history; the first being that which Senator Domenici would no doubt argue, that the support of the Los Alamos/Sandia axis has produced great benefits for the people of the state.

But compared to what? If we look at the performance of the other states at the bottom of the economic ladder, their statistics are little different from New Mexico, and yet they are the most research UN-intensive states in the union: Mississippi, Alabama, Arkansas are in the same collection of bottom feeders as New Mexico and they have received none of this federal dole. And the LEAST R&D intensive state is Wyoming, which is substantially above the USA average per capita personal income.

A second objection to this analysis would be that it ignores the recent strides made in the New Mexico high tech sector. There are a number of new companies in the biotech area that have sprung up around Albuquerque (see Table) this surely indicates a robust high tech presence.

But once again, compared to what? Every state

in the union has a high tech initiative and a high tech sector, which experience varying degrees of success. North Carolina, California, Massachusetts and Maryland come to mind as states that build immensely successful high tech establishments, mostly on the basis of private capital.

So what lessons can be gained from this long and tragic story?

In the first place, the New Mexico governmental high tech sector operates as a world unto itself, with little connection to the environment in which it sits. This may reflect the historical roots of Los Alamos and Sandia, which were born in the secrecy of the Second World War, and have always enjoyed a major focus on weapons production, which by its nature requires a high degree of isolation from the real world outside its doors. As long as this relationship endures, there is little chance that the tradition of education, intellectual attainment and excellence necessary for such an enterprise will permeate through the rest of the New Mexican society.

Secondly, there may be some validity to the conservative admonition that "you can't solve a problem by throwing money at it." As long as the high tech structure is designed to exclude the rest of the state, by its very nature it will never raise the quality of life, of education and the overall economy in a way that happens in places like Research Triangle NC, which from the outset focused on community development, job retraining, building of education and infrastructure.

Finally, from my personal experience of living in New Mexico I believe (on an anecdotal basis) that much of the population of the state harbors resentment toward the Sandia-Los Alamos axis as a governmental arm of the military industrial

complex. In this vision the laboratories are hostile to the world view of a resident community which traces its roots to ancient native American cultures predating the laboratories by thousands of years.

So politicians and promoters of hi tech should pause and consider the lessons of New Mexico as they consider their options, for without the accompanying commitment to the overall economic picture a hi tech presence will produce little overall benefit for its sponsors.

GAZELLE' COMPANIES	
Locally-grown bio-based companies that more than doubled their employment and increased their revenues by 50% in the last three years include:	
• COMPANY TITLE	ACTIVITIES
• ABC Coding Solutions	Allows healthcare practitioners to file electronic claims for services.
• Lumidigm Inc	Spinoff from InLight Solutions. Device identifies people based on their skin's optical properties. Recent development contract from Unisys Corp.
• MIOX Corporation	Water disinfectant technology originally developed by Los Alamos Technical Associates.
• Star Cryoelectronics	Manufactures sensors used in biomedical imaging.
OTHER METRO AREA BIO-BASED EMPLOYERS	
• Adherent Technologies, Inc.	Specialty polymers and processes for use in high-performance composites, coatings, foams, sensors, and recycling of polymer based scrap.
• Applied Research Associates	Provides innovative solutions to technical problems in science and engineering.
• Applied Technology Assoc. Inc/ATA Sensors	Specializes in all aspects of precision sensing, measurement and controls.
• Azano Pharmaceuticals	- developing technology to provide relief to lupus patients with severe kidney inflammation.
• B.A.S.I.C Dental Implant Systems, Inc.	- Produces several products that ease dental implants for both dentists and patients.
• Battelle Memorial Institute	Global science and technology enterprise that develops and commercializes technology and manages laboratories for customers.
• Biomoda, Inc.	Products that will be used for early diagnosis of cancer, and aid in the imaging and treatment of cancer.
• Cell Robotics International, Inc.	Sandia spinoff. Manufactures laser-based medical devices and scientific research instruments.
• CIC Photonics, Inc.	Designs and manufactures the most sensitive and robust

	White Cells and FTIR spectrometer accessories that are available in the marketplace today.
• CVI Lasers Corporation	Industry leader in the manufacturing of etalons and flat substrates.
• Daniel B Stephens & Assoc.	- Hydro geologic investigations, water resources planning and development.
• Decade Optical Systems/Decade Products, Inc./Armstrong Laser Technology, Inc.	Provides solutions for government and industrial sectors in the research and development, design, assembly, and automated production of advanced high-power laser diode arrays, solid-state laser systems, and related components and subsystems.
• DePuy Orthopedics	Designs, manufactures and distributes orthopedic devices and supplies including hip, knee, extremity, trauma, orthobiologics, and operating room products

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