

# **HIGHER EDUCATION & ENTREPRENEURSHIP IN COLORADO**

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ON BEHALF OF

THE SILICON FLATIRONS CENTER

AND

THE GOVERNOR'S INNOVATION COUNCIL

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## EXECUTIVE SUMMARY

Campus communities and entrepreneurial clusters overlap and affect one another. This Report examines entrepreneurial education led by Colorado's colleges and universities as well as through specific interactions between institutions of higher education and entrepreneurial clusters in Colorado.

This Report was commissioned by the Silicon Flatirons Center at the University of Colorado-Boulder. The Report is designed to support the efforts of the Governor's Innovation Council, an informal advisory body to Governor Bill Ritter. Promotion of entrepreneurship in Colorado is among the Innovation Council's areas of emphasis. These efforts spurred a Colorado delegation's March 2009 trip to Silicon Valley as well as Roundtable discussions on entrepreneurship and higher education held on December 11, 2008 at Colorado Law School and June 24, 2009 at the Bard Center.

This Report's ambition is three-fold. *First*, the analysis intends to stimulate the exchange of ideas concerning entrepreneurial education in and around Colorado's universities and colleges. *Second*, the Report aims to map many of the notable entrepreneurial initiatives across Colorado's campuses. To date such a compilation is missing. And *third*, the Report provided the intellectual framework for the June 24 Roundtable discussion which helped produce actionable items for the Governor's Innovation Council. Each of the views expressed in the Report do not necessarily represent the Innovation Council, the Roundtable Participants, the Silicon Flatirons Center, or Governor Ritter.

The Report proceeds in three parts. Part one of the Report looks outside of Colorado to offer a framework for understanding how higher education affects entrepreneurs. Research indicates that higher education affects five determinants of entrepreneurship: (1) entrepreneurial capabilities, (2) R&D and technology, (3) culture, (4) regulation, and (5) access to capital. "Entrepreneurship capabilities" are a type of capital in the form of talents, abilities, and assets that directly influence new business formation directly. Educational institutes influence these capabilities through entrepreneurship classes, programs and hiring practices that affect the training and experience of entrepreneurs, and through "entrepreneurial infrastructure" like support centers and incubators. In terms of R&D and technology, universities affect entrepreneurship through research discoveries and what is called the "university-industry interface," a broad term meant to describe the movement of people and technologies between academic institutions and industry.

On-campus culture affects entrepreneurship because while most university faculties favor government-funded research over commerce, those that encourage more commercial activity seem to promote more regional economic activity. Regulation in the form of statutes and university policies may also influence entrepreneurship. Finally, with respect to access to capital, increasing the amount of venture capital does not seem to affect performance, whereas increasing the number of good start-ups tends to draw venture capitalists.

Part one also highlights several innovative and effective efforts to promote entrepreneurship within higher education. The TI:GER program in Georgia and the Chalmers School of Entrepreneurship in Sweden, for example, both involve two-year programs in which students commercialize university research and form start-ups as part of their curriculum. Public-private partnerships in four states helped to attract entrepreneurial professors, commercially-oriented administrators, and

commercial research funding. Several small business development centers recently moved to a new model that helps entrepreneurs to access university resources and expertise. At MIT and Stanford, heightened levels of commercial research funding encourage increased entrepreneurship and heightened academic reputations for its faculty. Through efforts to engage with industry, the University of Utah now has the lowest cost per spin-out of any institution in the United States, while a number of states have created “funds of funds” that tie state investments in venture capital funds to investments in local firms, especially university spin-offs. Finally, some states have modified tenure policies and university charters to promote academic entrepreneurship, but the jury is still out on the effect of those programs.

Part two focuses on Colorado. Richard Florida talks about “mega-regions,” 12 locales that include 17 percent of the global population, produce two thirds of the world’s economic activity, and yield 90 percent of global innovation. The Front Range is a mega region thanks to Colorado’s universities and federal research labs. The three campuses of the University of Colorado, the two campuses of Colorado State University, the University of Denver, the Colorado School of Mines, Metro State College, the United States Air Force Academy, and the 14 federal laboratories all maintain initiatives designed to promote entrepreneurship and innovations. CU’s efforts revolve around the chancellor’s offices, the technology transfer office, the Deming Center for Entrepreneurship (in the Leeds School of Business), the Silicon Flatirons Center (in the Law School), the E-Ship Program at the College of Engineering and Applied Sciences, ATLAS, the Bard Center (part of UC-Denver’s Business School), the El Pomar Institute for Innovation and Commercialization at Colorado Springs, and the Anschutz Medical Campus, as well as surrounding clusters of entrepreneurial activity. CSU’s initiatives involve the president’s office, the Global Social and Sustainable Enterprise Program at the College of Business, the SuperClusters initiative, and the business community in Fort Collins. The Colorado School of Mines, as a matter of institutional focus, maintains a long tradition of interaction with industry but explicitly avoids setting up entrepreneurship centers. Metro State College focuses on social entrepreneurship and underserved communities, while the Air Force Academy offers entrepreneurship classes and two centers in which cadets and professors work to commercialize new technologies. Last but not least, the 14 federally-funded laboratories in Colorado provide for both educational programs and commercialization endeavors, the most vigorous occurring at the National Renewable Energy Laboratory in Golden. Outside of the Colorado Renewable Energy Collaboratory, however, Colorado’s universities and labs do not formally coordinate any of their efforts to enhance local entrepreneurship.

Part three considers the challenges and opportunities faced by Colorado colleges and universities in their efforts to better support entrepreneurship. If the goal of entrepreneurship education is to promote economic growth, then we must consider that highly-educated people produce innovations that drive employment, sales, profitability, economic growth, and standards of living. While it is tempting to suggest that Colorado’s federal laboratories and institutions of higher education can enhance entrepreneurship by copying strategies from other locales, academic research leads to a different conclusion. Simply increasing funding for generalized entrepreneurship education is not enough. Rather, Colorado should identify targeted initiatives which support highly-educated people who have already graduated from college and help them to start businesses in industries known for high growth and high barriers to entry (perhaps

protectable by patents). Given that increasing age seems to be the best predictor of successful self-employment, and that older people are less likely to leave Colorado upon graduation, Colorado universities and governments should pay special attention to strategies focused on highly-educated entrepreneurs with significant industry experience. Additionally, it should be considered how to best enhance experiential entrepreneurship programs. For example, programs modeled after the Chalmers School of Entrepreneurship in Sweden and the TI:GER program in Georgia could give students real-world, experiential learning opportunities without pulling professors or students away from existing departments, while at the same time helping universities to commercialize research discoveries. Overall, the ultimate goal should be to improve the quality of the pipeline of people and companies, and not just to produce more firms.

The June 24, 2009 Roundtable discussion identified potential initiatives Colorado universities should take to obtain their entrepreneurship goals. Specifically, the Roundtable discussants recognized the need to (1) raise public awareness concerning the already extensive range of existing entrepreneurship initiatives at colleges and universities; (2) facilitate sensible collaboration (e.g., grant writing) and information sharing among Colorado's higher educational institutions; and (3) establish a pan-university entrepreneurial forum or network which would facilitate the first two suggestions, as well as consider and weigh in on policy issues that affect entrepreneurial education. The group then recommended consideration of specific initiatives to accomplish these goals, including an entrepreneurship education clearinghouse, grassroots awareness drive, improved collaboration, and establishment of a policy forum.

# HIGHER EDUCATION & ENTREPRENEURSHIP IN COLORADO

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Campus communities and entrepreneurial clusters overlap with and affect one another.<sup>1</sup> Successful entrepreneurs fund campus buildings, license innovations from university laboratories, and help universities to spin off companies, while aspiring entrepreneurs pay tuition to learn about successful entrepreneurship.<sup>2</sup> In turn, colleges and universities produce people and technology for entrepreneurs' businesses.<sup>3</sup> Financiers and politicians influence both sides of the equation through capital and legislative policies.<sup>4</sup>

This Report examines how institutions of higher education and entrepreneurial clusters interact in Colorado. Part I explores the latest research on higher education and entrepreneurs, with a focus on particularly innovative programs outside of Colorado. Part II focuses on higher education and entrepreneurship in Colorado. Part III shows how Colorado colleges and universities can better support entrepreneurs.

## I. HIGHER EDUCATION AND ENTREPRENEURSHIP

Considering the programs and initiatives outside of Colorado, Part I notes that higher education affects five influences on entrepreneurship: (1) entrepreneurial capabilities, (2) R&D and technology, (3) culture, (4) regulation, and (5) access to capital.<sup>5</sup>

### A. Entrepreneurial Capabilities

Think of "entrepreneurship capabilities" as talents, abilities, and assets that influence new business formation directly.<sup>6</sup> Institutions of higher education affect entrepreneurial capabilities through entrepreneurship classes, programs, and hiring practices that affect the training and experience of local human capital, as well as through "entrepreneurial infrastructure" like support centers and incubators.

#### 1. Entrepreneurship Classes

Entrepreneurship classes try to boost the number of start-ups, improve start-up quality, and encourage creativity and other industrious behaviors. Entrepreneurship classes teach students

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<sup>1</sup> See, e.g., Henry Etzkowitz & Chunyan Zhou, *The Entrepreneurial University in Various Triple Helix Models* 1 (Jan 27, 2007).

<sup>2</sup> David Newton & Mark Hendricks, *Can Entrepreneurship be Taught?*, ENTREPRENEUR, Apr. 1, 2003, at 62; Jerome A. Katz, *The Chronology and Intellectual Trajectory of American Entrepreneurship Education 1876-1999*, 18 J. OF BUS. VENTURING 283 (2003).

<sup>3</sup> See RICHARD FLORIDA, *THE FLIGHT OF THE CREATIVE CLASS 251* (2005); Eric A. Hanushek & Ludger Wößmann, *The Role of Cognitive Skills in Economic Development* 31 (Mar. 4, 2008).

<sup>4</sup> Kalab A. Sieh, *The Entrepreneurial University* (Oct. 2, 2007), available at <http://tiny.cc/kU7eR>; David B. Audretsch, *Entrepreneurship Policy & the Strategic Management of Places 2* (2004).

<sup>5</sup> See SCOTT A. SHANE, *THE ILLUSIONS OF ENTREPRENEURSHIP 24* (2008); Sam Youl Lee, et al., *Creativity and Entrepreneurship: A Regional Analysis of New Firm Formation*, 38 REGIONAL STUDIES 879, 881 (2004); see OECD/Eurostate Entrepreneurship Indicators Programme (EIP), Indicator Chart Status (March 2008); cf. NIELS BOSMA, ET AL., *GLOBAL ENTREPRENEURSHIP MONITOR, 2007 EXECUTIVE REPORT 41*.

<sup>6</sup> Nadim Ahmad & Richard G. Seymour, OECD, *Defining Entrepreneurial Activity: Definitions Supporting Frameworks for Data Collection* 6 (Jan. 2008).

about business plans, entrepreneurial finance, start-up marketing, and related concerns.<sup>7</sup> Some schools even offer entrepreneurial “crash courses” and “boot camps” for working professionals on topics in marketing, business, and law.<sup>8</sup>

The Cincinnati Creates Companies (CCC) program teaches community members to write and refine business plans, and it hosts a business plan competition for program participants over the course of several months.<sup>9</sup> Universities even host seminars on commercialization and sponsor interdisciplinary colloquia for faculty in the hopes that some of them will take the entrepreneurial plunge for reasons that will become clear below.<sup>10</sup>

Driven by research demonstrating the value of hands-on learning, several philanthropies have supported the development of interdisciplinary entrepreneurship programs.<sup>11</sup> The TI:GER program places Georgia Tech graduate students from science, technology, engineering, and mathematics (STEM) disciplines on teams with Georgia Tech business students and Emory law students.<sup>12</sup> TI:GER participants take scientific discoveries from academic laboratories through an extended proof-of-concept exercise over the course of two years.<sup>13</sup> Sweden’s Chalmers School of Entrepreneurship likewise focuses students on starting companies for two years based upon university technologies, companies that now have a combined valuation exceeding €56 million.<sup>14</sup> Babson College, on the other hand, suffuses its entire curriculum with entrepreneurship education and produces leading scholarship relied upon by entrepreneurship educators.<sup>15</sup> Overall, however,

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<sup>7</sup> Karl H. Vesper & William B. Gartner, *Measuring Progress in Entrepreneurship Education*, 12 J. BUS. VENTURING 403, 412-13 tbl.5 (1997) (identifying 22 different kinds of entrepreneurship classes offered by 311 colleges and universities).

<sup>8</sup> Norris F. Krueger, et al., *From Bureaucratic Tech Transfer to Entrepreneurial Tech Commercialization 7* (2008) (unpublished manuscript, on file with author), available at <http://ssrn.com/abstract=1288942>. The Silicon Flatirons Center has sponsored “crash courses” for local entrepreneurs on topics ranging from intellectual property protection to marketing for web-based businesses to raising venture capital. Silicon Flatirons – Initiatives, <http://www.silicon-flatirons.org/initiatives.php?id=472>. The Leeds School of Business offers a series of two-day executive education classes focusing on accounting, finance, human resources, international business, management and leadership, and marketing. LEEDS School of Business, [http://leeds.colorado.edu/Executive\\_Education/interior.aspx?id=6586](http://leeds.colorado.edu/Executive_Education/interior.aspx?id=6586).

<sup>9</sup> The Small Business Innovation Research (SBIR) Program: Creating the Future Foundation of Science and Commerce, Before the H. Comm. on Sm. Bus., 110th Cong. 3 (Mar. 13, 2008) (statement of Dr. Charles H. Matthews, Ph.D., Professor of Entrepreneurship and Strategic Management, University of Cincinnati College of Business) [hereinafter Matthews Testimony].

<sup>10</sup> See Interview with Henry Nowak, Director, Center for Entrepreneurship, Colorado State University (Nov. 12, 2008) [hereinafter Nowak Interview]; Interview with Hunt Lambert, Assistant Vice President, Office of Economic Development, Colorado State University (Dec. 18, 2008) [hereinafter Lambert Interview].

<sup>11</sup> Interview with Paul Jerde, Director, Deming Center for Entrepreneurship, University of Colorado [hereinafter Jerde Interview]; See Krueger, *supra* note 8, at 12; Sarah Rimer, *At M.I.T., Large Lectures Are Going the Way of the Blackboard*, NY TIMES, Jan. 12, 2008, at A12.

<sup>12</sup> Benay Sager, et al., *Implications of a Multi-Disciplinary Educational and Research Environment: Perspectives of Future Business, Law, Science, and Engineering Professionals 4* (2004), available at <http://bit.ly/159ppa>.

<sup>13</sup> Sager, et al., *supra* note 12, at 4.

<sup>14</sup> Chalmers School of Entrepreneurship, Master’s Program, <http://bit.ly/eaKFL> (last visited Dec. 30, 2008).

<sup>15</sup> Newton & Hendricks, *supra* note 2; The Arthur M. Blank Center for Entrepreneurship at Babson College, Our Center, <http://bit.ly/2OsEfu> (last visited Dec. 9, 2008).

most entrepreneurship classes teach “about” entrepreneurship in a linear fashion through lectures, rather than engaging students in the non-linear activities involved in actually starting firms.<sup>16</sup>

## 2. Training and Experience

Given a choice between investing in (A) a dry cleaner run by a college drop-out or (B) an Internet company started by a Google executive with a doctorate in computer science and an MBA from a leading business school, a rational investor would probably choose the latter.<sup>17</sup> So of course the training and experience of entrepreneurs influences their successes, the number of start-ups formed, and the industries in which those start-ups operate.<sup>18</sup> Educational attainment also correlates strongly with entrepreneurial success – graduates of legal, architectural, and health-related professional programs start more firms than others, for example.<sup>19</sup> Professors start more high-tech ventures and invest more money in their firms than non-academic entrepreneurs, while the inclusion of “star scientists” professors as executives in bioscience start-ups seems to enhance success and the likelihood of follow-on investment.<sup>20</sup> Star scientist professors also increase patent filings, encourage other entrepreneurs to start biotechnology and nanotechnology firms, and enhance research productivity, especially when those scientists publish breakthrough papers.<sup>21</sup> In other words, success succeeds and advantages can help.<sup>22</sup>

To influence the training and experience of local entrepreneurs, some universities work with local officials to recruit commercially-oriented professors, administrators, and executives that work in particularly valuable industry sectors.<sup>23</sup> Utah State and the University of Utah both lobbied Governor John Huntsman to help attract “well-funded, world-class entrepreneurially-minded faculty that could collaborate in translational research areas that matched the State’s and University’s current clusters of expertise.”<sup>24</sup> Kentucky created a \$350 million fund to lure entrepreneurial researchers, required private parties to match 70% of all grants on a one-to-one basis, and mandated that grants focus on human health and development, bioscience, materials science and manufacturing, information technology and communications, and environmental and energy technologies.<sup>25</sup> The Georgia Research Alliance created 50 endowed chairs for

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<sup>16</sup> See Linda Edelman, et al., *Entrepreneurship Education: Correspondence Between Practices of Nascent Entrepreneurs and Textbook Prescriptions for Success*, 7 ACADEMY OF MNGT. LEARNING & ED. 56, 66 (2008).

<sup>17</sup> Shane, *supra* note 5, at 164.

<sup>18</sup> ELLIOTT C. KULAKOWSKI & LYNNE U. CHRONISTER, RESEARCH ADMINISTRATION AND MANAGEMENT 238 (2006).

<sup>19</sup> Acs, et al., *supra* note 7, at 9; SCOTT SHANE, ECONOMIC DEVELOPMENT THROUGH ENTREPRENEURSHIP 25 (2005).

<sup>20</sup> Christian Lüthje & Nikolaus Franke, *Fostering Entrepreneurship Through University Education and Training: Lessons From Massachusetts Institute Of Technology*, 2<sup>nd</sup> Annual Conference on Innovative Research in Management 2 (2002); Andrew A. Toole & Dirk Czarnitzki, *Biomedical Academic Entrepreneurship through the SBIR Program*, 63 J. ECON. BEHAVIOR 716, 717-18 (2007).

<sup>21</sup> Bruce Cassiman, et al., *Science Linkages and Innovation Performance: an Analysis on CIS-3 Firms in Belgium 5* (IESE Bus. School, Univ. of Navarra Working Paper No. 671, Jan. 2007); See Frank T. Rothaermel, et al., *University Entrepreneurship: A Taxonomy of the Literature*, 16 INDUSTRIAL & CORP. CHANGE 691, 765 (2007).

<sup>22</sup> Michiko Kakutani, *It’s True: Success Succeeds, and Advantages Can Help*, N.Y. TIMES, Nov. 17, 2008, at C1.

<sup>23</sup> KULAKOWSKI & CHRONISTER, *supra* note 18, at 238; Interview with Dr. Ronald Marler, D.V.M., Ph.D., Director, Laboratory Animal Resources and Histology, Mayo Clinic (Nov. 14, 2008) [hereinafter Marler Interview].

<sup>24</sup> Krueger, *supra* note 8, at 3.

<sup>25</sup> ECONOMIC DEVELOPMENT ADMINISTRATION, A RESOURCE GUIDE FOR TECHNOLOGY-BASED ECONOMIC DEVELOPMENT 21 (2006) [hereinafter, EDA REPORT].

entrepreneurial faculty focused on bioscience, optical systems, and vaccine development.<sup>26</sup> Focusing on managers, the Kansas Technology Enterprise Corporation (KTEC) advertises in university alumni publications to entice business leaders and investors under its “come home to Kansas” program.<sup>27</sup> South Dakota, likewise focusing on brain drain issues, guarantees start-up loans for university graduates if they stick around for five years after graduation.<sup>28</sup> Arizona State University deliberately hired a former Glaxo-SmithKline executive to run a research center to improve university-industry connections.<sup>29</sup>

### 3. Entrepreneurship Infrastructure

“Entrepreneurship infrastructure” refers to university-connected resources that support start-ups.<sup>30</sup> On-campus infrastructure can include academic entrepreneurship centers, business incubators, Small Business Development Centers (SBDCs), law school clinics, or even entrepreneur- or venture capitalist-in-residence programs.<sup>31</sup> Incubators help start-ups with below-market rents, consulting services, and mentoring initiatives.<sup>32</sup> SBDCs—a partnership between universities, local governments, and the federal government—similarly assist entrepreneurs with finance and training.<sup>33</sup> A growing number of law school clinics help entrepreneurs with contracts, entity formation, and intellectual property issues. Entrepreneur- or venture capitalist-in-residence programs facilitate access to capital and networks for entrepreneurs, while also acting as a search mechanism for good businesses, good people, and good technologies.<sup>34</sup> Venture capitalists thus play a bifurcated role, fueling entrepreneurs and supporting a process of industry restructuring that links economic actors to one another, to other financiers, and to global markets.<sup>35</sup>

Improvements in entrepreneurship infrastructure vary. Several SBDCs recently became Small Business and Technology Development Centers (SBTDC) to facilitate access to university expertise in licensing, commercialization, R&D, intellectual property, and finance.<sup>36</sup> The BIOSTART incubator at the University of Cincinnati builds initial proofs of concept for biotech innovations and conducts

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<sup>26</sup> KULAKOWSKI & CHRONISTER, *supra* note 18, at 238; EDA REPORT, *supra* note 25, at 20.

<sup>27</sup> Interview with Mark Wdowik, Chief Executive Officer, CSU Management Corporation. (Nov. 13, 2008) [hereinafter Wdowik Interview]; Come Home to Kansas, <http://www.comehometokansas.com> (last visited Jan. 5, 2009).

<sup>28</sup> Interview with Michael Lee Boucher, CEO, Dakota Legal Software (October 10, 2008).

<sup>29</sup> Marler Interview, *supra* note 23.

<sup>30</sup> See EDA REPORT, *supra* note 25, at 54.

<sup>31</sup> See, e.g. *id.* at 45.

<sup>32</sup> Sang Suk Lee & Jerome S. Osteryoung, *A Comparison of Success Factors for Effective Operations of University Business Incubators in the United States and Korea*, 42 J. SMALL BUS. MNGT. 418 (2004).

<sup>33</sup> Wdowik Interview, *supra* note 27.

<sup>34</sup> EWING MARION KAUFFMAN FOUNDATION, ENTREPRENEURSHIP SUMMIT EXECUTIVE SUMMARY 4 (Sept, 2008), <http://www.kauffman.org/uploadedFiles/entrepreneurshipsummitpaper9-03.pdf>; Rothaermel, et al., *supra* note 21, at 708; Krueger, *supra* note 8, at 10.

<sup>35</sup> AnnaLee Saxenian & Charles Sabel, *Venture Capital in the “Periphery”: The New Argonauts, Global Search, and Local Institution Building*, 84 ECON. GEO. 379, 382 (2008).

<sup>36</sup> SBTDC, SBTDC History & Mission, [http://www.sbtcd.org/about\\_us/history.asp](http://www.sbtcd.org/about_us/history.asp) (last visited Dec. 29, 2008); see also SMALL BUSINESS ADMINISTRATION, ANNUAL REPORT 22-23 (2007) (noting that nine programs had received the special SBTDC accreditation review, including those hosted by the Wharton School).



clinical studies that facilitate FDA approvals for biotechnology.<sup>37</sup> Law students at the University of Washington and Emory advise researchers on patentability by conducting freedom-to-operate searches.<sup>38</sup> The Department of Energy's entrepreneur-in-residence program houses venture capitalists in government research laboratories to facilitate innovation commercialization.<sup>39</sup> Executive-in-residence programs in Pittsburgh and St. Louis provide bioscience start-ups with pools of seasoned senior managers who help to manage company formation and pursue financing for local biotech start-ups.<sup>40</sup> KCSOURCELINK connects entrepreneurs with services and education provided by 140 non-profit organizations in the Kansas City area.<sup>41</sup> Finally, the Georgia Research Alliance (GRA) provides commercialization grants to professors through a Venture Labs program.<sup>42</sup>

The effect of entrepreneurial infrastructure varies by component and location. Each dollar spent on SBTDCs in North Carolina generated \$5.26 in incremental tax revenue over a ten year period and created substantial improvements among clients of SBTDCs, as compared to non-clients.<sup>43</sup> Incubator impact depends upon access to facilities and equipment, staff expertise, technology transfer and R&D, business and legal consulting, institutional networking, and government and community support.<sup>44</sup> Entrepreneur- and venture capitalist-in-residence programs help entrepreneurs to safeguard against uncertainty and help start-ups achieve higher productivity, grow R&D capabilities, enhance innovation, improve financial performance, boost sales, and increase the likelihood of firm survival.<sup>45</sup>

### B. R&D and Technology

R&D and technology generate economic growth and jobs.<sup>46</sup> But some R&D and technology entails substantial risks that most entrepreneurs would rather avoid.<sup>47</sup> Governments therefore rely upon research universities to conduct risky, long-term research, vesting institutions with patents derived from their discoveries so that universities can profit from those inventions.<sup>48</sup> University innovations spill over to the market through licenses and start-ups that in turn lead to

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<sup>37</sup> The Small Business Innovation Research (SBIR) Program: Creating the Future Foundation of Science and Commerce, Before the H. Comm. on Sm. Bus., 110th Cong. 3 (Mar. 13, 2008) (statement of Dr. Charles H. Matthews, Ph.D., Professor of Entrepreneurship and Strategic Management, University of Cincinnati College of Business).

<sup>38</sup> Interview with Dr. Gregory Graff, Associate Professor, Colorado State University (Nov. 14, 2008) [Hereinafter, Graff Interview].

<sup>39</sup> Krueger, *supra* note 8, at 10.

<sup>40</sup> See COLORADO BIOSCIENCE ASSOCIATION, COLORADO BIOSCIENCE ROADMAP 2008, 37 [hereinafter CBSA 2008 ROADMAP].

<sup>41</sup> EWING MARION KAUFFMAN FOUNDATION, *supra* note 34, at 4; KCSOURCELINK, About Us, <http://is.gd/vEXm> (last visited Jan. 7, 2009).

<sup>42</sup> Georgia Research Alliance Venture Lab, Roll Out and Seed Grants, <http://bit.ly/2lWt7k> (last visited Apr. 22, 2009).

<sup>43</sup> University of North Carolina Small Business and Technology Development Center, Impact, <http://bit.ly/7UgVJ> (last visited Apr. 23, 2009).

<sup>44</sup> Krueger, *supra* note 8, at 11; Lee & Osteryoung, *supra* note 32, at 419-20.

<sup>45</sup> Rothaermel, et al., *supra* note 21, at 765; Leslie H. Vincent & Sundar G. Bharadwaj, *It's Not What You Know, It's Who You Know: A Meta-Analytic Review of Social Networks* 7 (2005), available at <http://tiny.cc/CVV2I>.

<sup>46</sup> See SHANE, *supra* note 5, at 30; *id.* at 162.

<sup>47</sup> See SHANE, *supra* note 19, at 1.

<sup>48</sup> Irwin Feller, *An Historical Perspective on Government-University Partnerships to Enhance Entrepreneurship and Economic Development*, in ECONOMIC DEVELOPMENT THROUGH ENTREPRENEURSHIP 10 (Scott Shane, ed., 2005).

“cumulatively self-reinforcing agglomerations of technical skill, venture capital, specialized input suppliers and services, infrastructure, and spillovers of knowledge associated with proximity to universities and informal information flows.”<sup>49</sup> The ensuing economic growth helps regions to maintain the vitality of existing industries or to gain footholds in emerging industries.<sup>50</sup> In short, university-linked R&D and technology influences entrepreneurs through R&D investments and through the university-industry interface.<sup>51</sup>

### 1. R&D Investment

The source, focus, and destination of R&D investment influences entrepreneurship and commerce.<sup>52</sup> High levels of industry-funded research foster direct collaborations between professors and executives at MIT.<sup>53</sup> Interdisciplinary academic research centers bring together researchers from different academic departments into a common environment, which enhanced entrepreneurship in places like Silicon Valley.<sup>54</sup> The SBIR program fosters academic entrepreneurship in bioscience, MIT generates one patent per one million dollars of research funding, and Chicago at one time produced one start-up per staff member of its four-person venture capital unit.<sup>55</sup> Overall, the universities that compete most effectively for federal research dollars enjoy the most success in terms of spin-offs.<sup>56</sup>

Many universities have forged closer relationships with industry and local government to stabilize funding, relationships that involve consulting, contract research and development arrangements, interdisciplinary research centers, and public-private partnerships.<sup>57</sup> After all, while federally-funded research focused on life sciences grew after the Cold War, basic research funding for the physical sciences remained flat.<sup>58</sup> So the Georgia Research Alliance—a public-private partnership between industry, government, and Georgia’s four public universities—invests in key industries and has produced over 150 corporations and 5,500 new science and technology jobs, all under the aegis of a 25-person oversight board consisting of 6 university presidents and 19 businesspeople.<sup>59</sup>

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<sup>49</sup> AnnaLee Saxenian, *Inside-Out: Regional Networks and Industrial Adaptation in Silicon Valley and Route 128*, 2 CITYSCAPE 41, 42 (1996); see also Acs, et al., *supra* note 7, at 14.

<sup>50</sup> Acs, et al., *supra* note 7, at 3; see Mauri Laukkanen, *Exploring Alternative Approaches in High-Level Entrepreneurship Education: Creating Micro-Mechanisms for Endogenous Regional Growth*, 12 ENTREPRENEURSHIP & REG. DEV’T 25 (2000); see BATTELLE TECHNOLOGY PARTNERSHIP PRACTICE & SSTI, GROWING THE NATION’S BIOSCIENCE SECTOR XVII (2006); NATIONAL GOVERNOR’S ASSOCIATION, A GOVERNOR’S GUIDE TO CLUSTER-BASED ECONOMIC DEVELOPMENT 12 (2002); EDA REPORT, *supra* note 25, at 11.

<sup>51</sup> See Kenan Sahin, *Innovation and the University-Industry Interface*, Xconomy.com, Feb. 19, 2008, <http://bit.ly/11vD44>.

<sup>52</sup> See ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, COMPENDIUM OF PATENT STATISTICS 9 (2008) [hereinafter, OECD PATENT STATISTICS]; Krueger, *supra* note 8, at 3.

<sup>53</sup> Rory P. O’Shea, et al., *Delineating the Anatomy of an Entrepreneurial University: the Massachusetts Institute of Technology Experience*, 37 R&D MNGT. 1, 5-6 (2007).

<sup>54</sup> See *Id.* at 8; Interview with Drs. John M. Poate and Will Vaughan, Colorado School of Mines (Oct. 20, 2008) [hereinafter Poate & Vaughan Interview]; Henry Etzkowitz, *Research Groups as ‘Quasi-Firms’: the Invention of the Entrepreneurial University*, 32 RES. POL’Y 109, 114-15 (2003).

<sup>55</sup> *Id.* at 112 nt.2; see Toole & Czarnitzki, *supra* note 20, at 717-18.

<sup>56</sup> Etzkowitz, *supra* note 54, at 120.

<sup>57</sup> Rothaermel, et al., *supra* note 21, at 695; EDA REPORT, *supra* note 25, at 13; Etzkowitz, *supra* note 54, at 115.

<sup>58</sup> Galama & Hosek, *supra* note 79, at xvi.

<sup>59</sup> Jay Kayne, Kauffman Center for Entrepreneurial Leadership, *State Entrepreneurship Policies and Programs* 30 (Nov. 1999); Georgia Research Alliance, GRA’s Origins, <http://bit.ly/AjWKD> (last visited Nov. 17, 2008).

The Utah Science Technology and Research (USTAR) initiative directed \$125 million to Utah State University and the University of Utah for applied research, spin-outs, cross-disciplinary research centers, and five innovation centers that provide entrepreneurs with access to university resources.<sup>60</sup> Industry leaders, politicians, and university leaders in Arizona worked together to fund a billion-dollar program that altered the pipeline of innovations flowing out of Northern Arizona University, the University of Arizona, and Arizona State University.<sup>61</sup> Massachusetts likewise created a billion-dollar life sciences initiative that also funds university bioscience.<sup>62</sup> On a smaller scale, KTEC uses funds from the Kansas state lottery to fund applied R&D.<sup>63</sup> Scientists at the Mayo Clinic conduct research on behalf of outside companies because those companies value what is “between their ears.”<sup>64</sup> Such “[p]ublic entrepreneurship translates imperceptibly and naturally into private entrepreneurship and vice versa.”<sup>65</sup>

## 2. University-Industry Interface

Technologically-driven, entrepreneurial economies depend upon mechanisms that facilitate the movement of people and technology between universities and the market.<sup>66</sup> E-mentoring programs, student consulting projects, guest lectures, and student internships not only support the movement and development of human capital, they also increase awareness of entrepreneurship, provide an important base of human capital for local firms, encourage experiential learning, alter the perceptions of students and business owners, and may even turn students into entrepreneurs.<sup>67</sup> Technology transfer offices (TTOs), which take technologies through a commercialization process that increases the marketability of academic discoveries, bring buyers and sellers of innovations together while also reducing the uncertainty associated with early-stage innovations.<sup>68</sup> Technology transfer also reduces certain risks for entrepreneurs who engage with universities, since those not privy to disruptive innovations coming from university labs face increased economic uncertainty.<sup>69</sup> With a robust and strategically-oriented TTO in place, academic entrepreneurs interact with and learn from experienced industry professionals who teach them about how to start companies and may even provide the resources to do so.<sup>70</sup> Unfortunately, however, many universities lack

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<sup>60</sup> innovationUTAH.com, About USTAR, <http://www.innovationutah.com/aboutustar.html> (last visited Nov. 17, 2008); Krueger, *supra* note 8, at 3; Nowak Interview, *supra* note 10.

<sup>61</sup> Steven G. Zylstra, *Technology Transfer and Commercialization of University Performed Research: The Arizona Experience*, in AAAS SCIENCE AND TECHNOLOGY POLICY YEARBOOK 287-89 (2001); Nowak Interview, *supra* note 10; Kayne, *supra* note 59, at 30; Marler Interview, *supra* note 23.

<sup>62</sup> CBSA 2008 ROADMAP, *supra* note 40, at ES-9; Acs, et al., *supra* note 7, at 14.

<sup>63</sup> Wdowik Interview, *supra* note 27.

<sup>64</sup> Marler Interview, *supra* note 23.

<sup>65</sup> Etzkowitz, *supra* note 54, at 120.

<sup>66</sup> BOSMA, ET AL., *supra* note 5, at 41; EDA REPORT, *supra* note 25, at 7.

<sup>67</sup> See Luke Pittaway & Jason Cope, *Entrepreneurship Education: A Systematic Review of the Evidence*, 25 INT’L SMALL BUS. J 479, 489-90 (2007).

<sup>68</sup> *Id.*

<sup>69</sup> Etzkowitz, *supra* note 54, at 118.

<sup>70</sup> Pittaway & Cope, *supra* note 67, at 489.

invention disclosure mechanisms that allow intellectual property to spill over, and many professors lack incentives to engage in commercialization and technology transfer.<sup>71</sup>

Because TTOs and professors often ignore the steps required to commercialize untested technologies, universities have instituted measures designed to improve the university-industry interface.<sup>72</sup> The University of Utah undertook an examination of its core strengths to identify synergies with local clusters and created related centers of excellence that led to the creation of more than 60 spin-outs in three years with the lowest cost per spin-out in the United States.<sup>73</sup> MIT's TTO encourages the prompt disclosure of technological innovations by faculty, quickly evaluates the market value of those inventions, protects IP, and meets with venture capitalists to discuss new technologies.<sup>74</sup> Scholarships in Utah pay graduate students to help assess and package university technologies for subsequent investment.<sup>75</sup> Universities and their corporate sponsors recently formed the University-Industry Demonstration Partnership to develop tools like TurboNegotiator, a web-based program that streamlines negotiating strategic partnerships.<sup>76</sup> MIT's Deshpande Center for Technological Innovation helps professors with promising ideas to develop those ideas faster and more effectively with a small infusion of grant money and with expert advice.<sup>77</sup> Stanford, Harvard, and MIT all deliberately remove lawyers from the licensing process while avoiding deviation from standard warranties and indemnifications.<sup>78</sup> Overall, however, universities and associated research institutions can enhance firm formation by integrating with industry networks, supporting the structure and dynamics of regional economies, and fostering complex "social relationships within and between firms and between firms and local institutions."<sup>79</sup>

### C. Culture

Universities often eschew commerce.<sup>80</sup> Peer-reviewed government grants from the National Science Foundation (NSF) and other agencies indicate academic research quality, while

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<sup>71</sup> Krueger, *supra* note 8, at 5; Interview with David Allen, Associate Vice President for Technology Transfer at the University of Colorado, and Kate Tallman, Director of Technology Transfer for the University of Colorado at Boulder and the University of Colorado at Colorado Springs (Oct. 31, 2008) [hereinafter CU TTO Interview].

<sup>72</sup> Toole & Czarnitzki, *supra* note 20, at 721.

<sup>73</sup> Krueger, *supra* note 8, at 1.

<sup>74</sup> O'Shea, *supra* note 53, at 6.

<sup>75</sup> Krueger, *supra* note 8, at 8.

<sup>76</sup> University-Industry Demonstration Partnership, About UIDP, [http://www.uidp.org/ABOUT\\_UIDP.html](http://www.uidp.org/ABOUT_UIDP.html) (last visited Dec. 29, 2008); Wdowik Interview, *supra* note 27.

<sup>77</sup> O'Shea, *supra* note 53, at 7.

<sup>78</sup> Lawrence Fisher, *The Innovation Incubator: Technology Transfer at Stanford University*, STRATEGY + BUS., available at <http://bit.ly/lxOtN> (noting a desire to place creative deal-making ahead of contract negotiations in executing technology licenses).

<sup>79</sup> See NATIONAL GOVERNOR'S ASSOCIATION, *supra* note 50, at 24 (noting that North Carolina "has developed a sizable biotechnology industry—that can now claim to be a cluster—based largely on the research strength of its three world-class universities by organized and supported by a center."); Titus Galama & James Hosek, RAND National Defense Research Institute, U.S. Competitiveness in Science and Technology xvi (2008) (tying U.S. competitiveness in Science and Technology to universities); Rothaermel, et al., *supra* note 21, at 775; see Saxenian, *supra* note 49, at 57.

<sup>80</sup> Krueger, *supra* note 8, at 6; Lambert Interview, *supra* note 10; Rothaermel, et al., *supra* note 21, at 738; Interview with Lori-Anne Meyers, Executive Recruiter (Oct. 28, 2008) [hereinafter Meyers Interview].

commercially-funded research seems biased.<sup>81</sup> Faculty promotions depend upon scientific discoveries, publications, and teaching, but not commercial endeavors.<sup>82</sup> At MIT, however, “scientists, engineers, and managers believe that it is not enough merely to invent a new product, concept or technology. The measure of success is global commercialization and widespread acceptance of their innovations.”<sup>83</sup> Stanford, likewise entrepreneurial in its orientation and outlook, remains a leading research and teaching institution.<sup>84</sup> Unsurprisingly, environments like Silicon Valley and Route 128 produce more start-ups.<sup>85</sup>

But campus culture is fluid and subject to influence.<sup>86</sup> Michael Young removed the TTO from under the Vice President for Research at the University of Utah, re-branded the TTO as the “commercialization office,” and aligned it with the business school and entrepreneurship programs.<sup>87</sup> After a new director of commercialization engaged with every key constituency in the university, as well as industry and government, “Utah found potential entrepreneurs coming out of the woodwork.”<sup>88</sup> Indeed, “[a]s the scope of an entrepreneurial university expands, the core of the system self-organizes to renew and transform its mission, and moves toward embracing an economic development mandate.”<sup>89</sup>

Other universities change campus culture through incentives.<sup>90</sup> Investigators at the Mayo Clinic receive 40 percent of the licensing revenue from their inventions up to one million dollars, and a declining percentage over that level.<sup>91</sup> At one university, TTO personnel (instead of professors) receive licensing incentives.<sup>92</sup> Faculty must prove the commercial potential of research to receive grants from a \$10 million fund at ASU managed by local business leaders.<sup>93</sup> A lack of ongoing support for MIT professors encourages them to find outside funding.<sup>94</sup> The expansion of post-graduate education at ASU with a commercial focus and a supporting infrastructure attracted students who changed ASU’s culture.<sup>95</sup> To date, however, scientific literature does not show a

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<sup>81</sup> Interview with Kurt Smith, Director, Engineering and Entrepreneurship Program, University of Colorado College of Engineering and Applied Sciences [hereinafter Smith Interview]; Interview with Tom Lookabaugh, Chief Executive Officer, PolyCypher [hereinafter Lookabaugh Interview]; see also Janet Rae-Dupree, *When Academia Puts Profit Ahead of Wonder*, N.Y. TIMES, Sept. 6, 2008, at BU4.

<sup>82</sup> Toole & Czarnitzki, *supra* note 20, at 721.

<sup>83</sup> O’Shea, *supra* note 53, at 8.

<sup>84</sup> Etzkowitz, *supra* note 54, at 115.

<sup>85</sup> See Pittaway & Cope, *supra* note 67, at 485.

<sup>86</sup> See Rita Klapper, *Government Goals and Entrepreneurship Education – An Investigation at a Grand Ecole in France*, 46 ED. & TRAINING 127, 135 (2004); Rothaermel, et al., *supra* note 21, at 738; but see Acs, et al., *supra* note 7, at 13 (noting a lack of evidence indicating “that culture is important to entrepreneurship intensity in particular regions[.]”).

<sup>87</sup> Krueger, *supra* note 8, at 2.

<sup>88</sup> See Krueger, *supra* note 8, at 3-5.

<sup>89</sup> Rothaermel, et al., *supra* note 21, at 708.

<sup>90</sup> See Krueger, *supra* note 8, at 10; Rothaermel, et al., *supra* note 21, at 738.

<sup>91</sup> Marler Interview, *supra* note 23. Over \$1 million, the percentage declines to 30 percent.

<sup>92</sup> Rothaermel, et al., *supra* note 21, at 709.

<sup>93</sup> Marler Interview, *supra* note 23.

<sup>94</sup> O’Shea, *supra* note 53, at 9.

<sup>95</sup> Marler Interview, *supra* note 23.

definitive link between modified incentive structures and enhanced entrepreneurial activity on campus.<sup>96</sup>

#### *D. Access to Finance*

Debt, angel investments, venture capital, the public capital markets, and other forms of equity fuel start-ups.<sup>97</sup> Venture capital receives a lot of attention, even though angels actually supply most early-stage start-up financing.<sup>98</sup> But venture capital facilitates access to both money and experienced managers. For this reason, Israel “bought minority stakes in competing, private venture capital firms, structured as limited partnerships between Israeli venture capitalists and their foreign counterparts, thus ensuring connections to global as well as local networks.”<sup>99</sup> States like Utah and Michigan replicated the Israeli model and developed “funds of funds” that tie state investments in venture capital to investments in local firms, including local university spin-offs.<sup>100</sup> (Notably, increased levels of venture capital do not yield more high-growth start-ups, while improved pipelines of companies do tend to attract more financiers.<sup>101</sup>)

Universities facilitate access to capital through a variety of channels, including technology transfer.<sup>102</sup> The university foundations at Purdue and the University of Illinois invest funds in early-stage spin-offs.<sup>103</sup> Spin-offs also secure capital for commercialization from SBIR grants, cooperative research and development agreements, the NIST Technology Innovation Program, and other programs.<sup>104</sup> Such initial public investments in early-stage companies reduce the time within which venture capitalists will invest, increase the net present value of investment opportunities by shifting the risk of failure to the government, and allow private follow-on investors to increase their returns by leveraging their funds against public investments.<sup>105</sup> To the extent that universities assist academic entrepreneurs in securing those grants and access to financiers, universities influence how entrepreneurs start companies.

#### *E. Regulatory Framework*

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<sup>96</sup> See Rothaermel, et al., *supra* note 21, at 739.

<sup>97</sup> EWING MARION KAUFFMAN FOUNDATION, *supra* note 34, at 10. Other sources of financing can include revolving loan funds, micro-loan programs, the Small Business Administration 7(a) program, or SBIR loans.

<sup>98</sup> *Id.*; See also A Postcard from the Valley of Death, Before the H. Comm. on Sci. & Tech, 110th Cong. 2 (Mar. 11, 2008) (statement of Dr. Peter S. Fiske, Co-Founder, RAPT Industries Inc.) [hereinafter, Fiske Testimony].

<sup>99</sup> Saxenian & Sabel, *supra* note 35, at 389.

<sup>100</sup> EWING MARION KAUFFMAN FOUNDATION, *supra* note 34, at 11-12.

<sup>101</sup> SHANE, *supra* note 5, at 28; see also Kayne, *supra* note 59, at 6 (noting a belief among states that the creation of venture capital pools and the expansion of small business development centers best support entrepreneurs).

<sup>102</sup> See Toole & Czarnitzki, *supra* note 20, at 721.

<sup>103</sup> Wdowik Interview, *supra* note 27.

<sup>104</sup> Frank T. Rothaermel & David L. Deeds, *Exploration and Exploitation Alliances in Biotechnology: A System of New Product Development*, 25 STRAT. MGMT. 201, 205 (2004); Fiske Testimony, *supra* note 98, at 2; Toole & Czarnitzki, *supra* note 20, at 721.

<sup>105</sup> Toole & Czarnitzki, *supra* note 20, at 721.

Federal and state regulations influence academic and non-academic entrepreneurs alike.<sup>106</sup> A product of lobbying by universities, the Bayh-Dole Act vests universities with title to patents derived from federally-funded research. Some state leaders have sought to modify local statutes and university policies to promote academic entrepreneurship. The governor of Texas proposed that all public universities in Texas should include commercial activities as a factor in tenure decisions, so “Texas A&M University became...the first public university in the United States to formally incorporate commercialization (as measured by deal flow) into its criteria for granting tenure.”<sup>107</sup> Faculty champions at the University of Utah pushed a revised tenure formula through the faculty senate that accounted for intellectual property production and commercial pursuits.<sup>108</sup> At least half the states in the nation are now redefining the “service” and “outreach” elements in university charters to account for the university-industry interface.<sup>109</sup> A few states offer tax breaks and subsidies to firms that rely upon local academic expertise.<sup>110</sup>

Clear and strict conflict of interest policies allow academic entrepreneurship through technology transfer and commercialization.<sup>111</sup> At MIT, spin-offs may not operate on campus after formation and faculty members may not be line officers of a company, must report all outside consulting activities with start-ups, may not negotiate licensing terms, may not hold research confidentially, and must operate at arms’ length from university spin-offs.<sup>112</sup> Such policies have two objectives: to ensure the openness of information flow in classrooms and laboratories, and to shield research agendas in university laboratories from improper influence.<sup>113</sup> By the same token, however, MIT neither discourages nor promotes commercial activities.<sup>114</sup>

Whether regulatory measures succeed in promoting entrepreneurship remains to be seen. The evidence on the Bayh-Dole Act remains inconclusive.<sup>115</sup> Tenure decisions made based upon a candidate’s commercial activities or patents occur before the quality of intellectual property becomes apparent and before commercial activities demonstrate success.<sup>116</sup> Scholarship on industry-specific tax breaks is highly negative.<sup>117</sup> For these and other reasons, some Colorado-based experts on entrepreneurship recommend a passive-positive approach towards on-campus commercial activities; rather than explicitly promoting academic entrepreneurship, it may make more sense to avoid penalizing on-campus commercial activities by professors and students.<sup>118</sup>

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<sup>106</sup> See Pittaway & Cope, *supra* note 67, at 487; Interview with Brad Feld, Managing Partner, Foundry Group (Oct. 15, 2008) [hereinafter Feld Interview].

<sup>107</sup> Kauffman Foundation & The International Economic Development Council, Entrepreneurship Summit 12 (Sept. 2008).

<sup>108</sup> Nowak Interview, *supra* note 10.

<sup>109</sup> *Id.*

<sup>110</sup> See Acs, et al., *supra* note 7, at 22-23.

<sup>111</sup> O’Shea, *supra* note 53, at 7.

<sup>112</sup> *Id.*

<sup>113</sup> *Id.* at 8-9.

<sup>114</sup> *Id.* at 9.

<sup>115</sup> Rothaermel, et al., *supra* note 21, at 709.

<sup>116</sup> CU TTO Interview, *supra* note 71.

<sup>117</sup> See Acs, et al., *supra* note 7, at 23.

<sup>118</sup> See Appendix A, *infra*, at 27.

## II. COLORADO, CAMPUSES, AND ENTREPRENEURSHIP<sup>119</sup>

Colorado's universities and federal research labs fuel innovation and economic growth along the Front Range.<sup>120</sup> The University of Colorado (CU), Colorado State University (CSU), the Colorado School of Mines (Mines), and the University of Denver (DU) supply the professional, scientific, and technical services sector with critically important technologies through technology transfer.<sup>121</sup> Fourteen federal research laboratories and their academic affiliates added \$1.25 billion to the Colorado economy in 2008.<sup>122</sup> The Front Range qualifies as one of Economist Richard Florida's "mega-regions," one of just 12 locales that includes only 17 percent of the global population but produce two thirds of the world's economic activity and 90 percent of world innovations.<sup>123</sup> As in other mega-regions, higher education appears to bear a direct relationship to entrepreneurship and innovative growth in Colorado.<sup>124</sup>

Colorado's public research institutions appear to fuel economic growth through innovation and people.<sup>125</sup> Legislators fund research in aerospace, bioscience, renewable/clean energy, and information technology in the hopes of producing more technology.<sup>126</sup> Research institutions then patent innovations in "life sciences, engineering, material sciences, computer sciences, photonics or nanotechnology[.]"<sup>127</sup> The newly-formed Colorado Renewable Energy Collaboratory now supports industry-sponsored research at CU, CSU, Mines, and the National Renewable Energy Laboratory (NREL).<sup>128</sup> But the role of Colorado's institutions of higher education as producers of start-ups remains largely unexplored, a fact which the following subsections seek to remedy.

### A. *The University of Colorado*

CU stands out in terms of research quantity and the number of companies and technologies produced. CU-Boulder attracted \$280 million of research funds in 2008, 79 percent of it from federal sources, whereas UC-Denver pulled in \$371 million, mostly from the National Institutes of Health.<sup>129</sup> CU ranks seventh in the nation in the number of companies created from its IP, 12th in

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<sup>119</sup> All unattributed assertions in Part II come from interviews with members of the local community.

<sup>120</sup> Lee, et al., *supra* note 5, at 886 tbl.3; Acs, et al., *supra* note 7, at 2; ROBERT D. ATKINSON & DANIEL K. CORREA, THE INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION, THE 2007 STATE NEW ECONOMY INDEX, 18.

<sup>121</sup> See Forty-Third Annual Colorado Business Economic Outlook 2008, 60.

<sup>122</sup> See CO-LABS, CO-LABS Economic Impact Study: The Impact of Federally Funded Research Laboratories in Colorado 3 (May 2008), available at <http://tiny.cc/gN10S>.

<sup>123</sup> Richard Florida, *Among the 40 'megs': Denver Grabs Lofty Rank in Global Economy*, ROCKY MOUNTAIN NEWS, Mar. 22, 2008, <http://tiny.cc/IK6YP>; see also OECD PATENT STATISTICS, *supra* note 52, at 13-19.

<sup>124</sup> See Appendix B, *infra*.

<sup>125</sup> Edward J. Malecki, *Cities and Regions Competing in the Global Economy: Knowledge and Local Development Policies*, 25 ENVIRONMENT & PLANNING C: GOV'T & POL'Y 638, 642 (2007).

<sup>126</sup> See CBSA 2008 ROADMAP, *supra* note 40, at ES-3; Press Release, Office of Governor Bill Ritter, Jr., Gov. Ritter Announces 2009 Economic Proposals (Dec. 18, 2009), available at <http://tiny.cc/qt1pq>; COLO. REV. STAT. § 24-48.5-108 (2008).

<sup>127</sup> See COLO. REV. STAT. § 24-48.5-108(3)(b.5)(I) (2008).

<sup>128</sup> Gargi Chakrabarty, *Solar mirrors could array near DIA*, ROCKY MOUNTAIN NEWS, Feb. 28, 2008, available at <http://www.rockymountainnews.com/news/2008/feb/28/solar-mirrors-could-array-near-dia/>; Richard Valenty, *Coming through for CU: Ritter Signs Biotech Bill, Will Sign Budget Monday*, COLO. DAILY, Apr. 27, 2008, available at <http://bit.ly/YzG31>; Colorado Renewable Energy Collaboratory, Presentation at the IEEE Colorado Symposium (May 17, 2008), <http://tiny.cc/BfPaC>.

<sup>129</sup> University of Colorado at Boulder, Awards by Funding Agency 1 (2008), <http://is.gd/uLZk>.



the cumulative number of inventions reported by faculty, and 13th in terms of cumulative income.<sup>130</sup> Entities and individuals across the university partner with external organizations like the Boulder Innovation Center, TechStars (a Boulder start-up accelerator), a monthly congregation of about 300 individuals called the Boulder/Denver NewTech Meetup, the Colorado Springs Technology Incubator, and the Fitzsimons BioBusiness Partners. Beyond that, additionally, several divisions of the University of Colorado actively seek to foster on-campus entrepreneurship, including the Chancellor's Office, the TTO, the Deming Center, Silicon Flatirons Center, eShip, and the Bard Center.

### 1. University of Colorado System

The CU-Boulder Chancellor plans to add entrepreneurship professors and classes in which students start new businesses.<sup>131</sup> CU also hopes to form a R&D partnership with CSU, Mines, and DU.<sup>132</sup> But that research partnership will require coordination between university TTOs, which identify, protect, and license inventions derived from university research.<sup>133</sup> At present, however, CU's TTO does not actively work to produce spin-offs due to limited near-term rewards.<sup>134</sup> Instead, CU's TTO emphasizes licenses in bioscience and materials science because the assets are usually patent-protected and the research well-funded.<sup>135</sup> To be sure, CU's TTO focuses on technology maturation, trying to bridge the so-called "valley of death" between invention and commercialization with a Proof of Concept Grant (POCg) program that helps professors demonstrate the commercial potential of their innovations, as well as a Proof of Concept Investment (POCi) program that provides early-stage convertible debt used to prove out technologies.<sup>136</sup> CU also helps faculty founders to identify managers and financiers, but turns to incubators and outside volunteers to build companies.<sup>137</sup>

CU's TTO tries to enhance the university-industry interface through marketing and outreach programs, encouraging faculty to discuss commercialization with their colleagues, meeting with department chairs and administrators, producing marketing materials and newsletters, giving out awards, and holding seminars.<sup>138</sup> To date, only a few departments within CU (biomedical engineering, chemical engineering, and medicine) reward commercialization and licensing activity.<sup>139</sup>

CU also provides entrepreneurship classes. Entrepreneurship education occurs at the Leeds School in Boulder, the College of Business at the University of Colorado-Colorado Springs (UCCS), the Business School at UC-Denver, the College of Engineering and Applied Science (CEAS) in Boulder,

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<sup>130</sup> Press Release, University of Colorado Technology Transfer Office, National Data Places CU Technology Transfer among Top Performers (Feb. 11, 2009), <http://is.gd/uLDv>.

<sup>131</sup> Flagship 2030 Strategic Plan, at 33-47

<sup>132</sup> Flagship 2030 Strategic Plan, at 49.

<sup>133</sup> CU TTO Interview, *supra* note 71.

<sup>134</sup> *Id.*; Toole & Czarnitzki, *supra* note 20, at 721.

<sup>135</sup> CU TTO Interview, *supra* note 71.

<sup>136</sup> CBSA 2008 ROADMAP, *supra* note 40, at ES-3.

<sup>137</sup> Meyers Interview, *supra* note 80; *see* CU TTO Interview, *supra* note 71.

<sup>138</sup> CU TTO Interview, *supra* note 71.

<sup>139</sup> CU TTO Interview, *supra* note 71.

and at Colorado Law.<sup>140</sup> All told, CU offers 41 different undergraduate- and graduate-level classes tied to entrepreneurship. Moreover, a quasi-federated network of educators study and promote entrepreneurship on three different campuses and across several disciplines (law, business, engineering, and medicine), focusing on industry clusters in information technology, organics, clean technology, bioscience, and national security.<sup>141</sup> This network of educators often collaborates to sponsor cross-campus events promoting entrepreneurship. April 2009 saw the inaugural “Entrepreneurship Week” at CU Boulder sponsored by the Silicon Flatirons Center, the Deming Center, E-ship, ATLAS, and the TTO.<sup>142</sup> Entrepreneurship Week involved a series of classes, conferences, and social events culminating in the finals of the CU New Venture Challenge business plan competition.<sup>143</sup> In addition to their collaborative efforts, each of the sponsoring organizations has its own niche in the entrepreneurial ecosystem. I consider each of the entities in the network of entrepreneurial educators in turn below.

## 2. The Deming Center for Entrepreneurship at the Leeds School

Deming fosters an entrepreneurial mindset across the university through entrepreneurship classes delivered primarily via lectures at the Leeds School of Business. Deming cross-lists many courses with other campus units through interdisciplinary certificate programs like the Engineering and Entrepreneurship program in the College of Engineering & Applied Science, the Lockheed Martin Engineering Management Program, as well as a certificate in entrepreneurial law offered by Colorado Law. An experiential learning class, “Projects in Entrepreneurial Companies,” accepts only 12 MBA students per semester and requires students to negotiate with established entities to define a consulting project.<sup>144</sup> Beyond that, students can take an integrative capstone class focused on business planning and participate in three separate business plan competitions. These competitions include the Cleantech Venture Challenge and Sustainable Venturing Initiative led by Deming, as well as the year-long CU New Venture Challenge. Leeds was among the first schools to offer a doctoral program in entrepreneurship. This helped the Deming Center cultivate a national reputation. Additionally, the Center has garnered several awards for innovative programming.

Deming positions itself as a university-wide brand and interface between businesses and the institution. To do so, the Center adheres to an industry cluster model focused on clean technology, sustainable ventures, organics, biotechnology, and aerospace, reflecting both the strengths of the University of Colorado and the Colorado economy.

## 3. The Silicon Flatirons Center at Colorado Law School

The Silicon Flatirons Center (SFC) focuses on entrepreneurship in the so-called Mile High Tech community, which includes the Front Range information and communications technology (ICT)

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<sup>140</sup>Leeds School of Business, Home, <http://leeds.colorado.edu/> (last visited Oct. 6, 2008); University of Colorado at Colorado Springs, College of Business, <http://business.uccs.edu/> (last visited Oct. 6, 2008); University of Colorado Denver, The Business School, <http://www.business.cudenver.edu/> (last visited Oct. 6, 2008).

<sup>141</sup> Interview with J. Brad Bernthal, Associate Clinical Professor of Law, University of Colorado (Oct. 31, 2008) [hereinafter Bernthal Interview].

<sup>142</sup> CU Entrepreneurship Week, <http://entrepweek.org/index.html>.

<sup>143</sup> *Id.*

<sup>144</sup> THE DEMING CENTER, ANNUAL REPORT 11 (2008).

industry.<sup>145</sup> In particular, SFC oversees and operates several initiatives which facilitate networking interactions between CU- Boulder and the local entrepreneurial community. On a monthly basis, the Boulder/Denver New Technology Meet-Up attracts 300 members of the entrepreneurial community to a campus networking event that features show-and-tell demonstrations of new businesses. A Crash Course Series for Entrepreneurs supplements the New Technology meet-ups by providing free educational modules to first-time entrepreneurs. And SFC's monthly Entrepreneurs Unplugged series brings serial entrepreneurs to campus to talk about their experiences in starting businesses.

SFC additionally trains law students interested in law and entrepreneurship. SFC offerings for law students include an experiential class, the entrepreneurial law clinic (ELC). The ELC provides legal help without charge to area start-up businesses. Third-year law students staff the ELC under the supervision of a full-time clinician and attorney-advisors from the community. The Clinic differs from other entrepreneurship classes by training students to help entrepreneurs instead of helping students become entrepreneurs.<sup>146</sup> ELC students interact directly with clients on a variety of issues including entity formation, intellectual property, employment, and contracts. Clients of the clinic include individual entrepreneurs, start-up companies, professors, graduate students, and entrepreneurs with special needs, all of whom receive free legal services. SFC also supports a certificate program for law students in entrepreneurial law. To receive the certificate, students must participate in the ELC and several other classes so that students learn about issues typically faced by transaction-side lawyers who work with entrepreneurs.

#### 4. E-Ship in the College of Engineering and Applied Sciences at CU Boulder

The Engineering Entrepreneurship Certificate Program (E-ship) integrates entrepreneurship education into the upper-level engineering curriculum for undergraduate students, graduate students, and working professionals. In addition to engineering classes, students in the E-ship program learn about management and leadership, finance, marketing, and business plan preparation. By combining a design project with entrepreneurship education and development of a business plan based on the design project, E-ship creates a hands-on product development experience. Overall, E-ship aims to have the majority of engineers from the College of Engineering and Applied Sciences (CEAS) graduating with a background in entrepreneurship.

#### 5. The Bard Center and the UC-Denver Business School

Bard supports an eleven-month MBA program, entrepreneurship certificate programs, classes on entrepreneurship and social sector innovation, and an incubator housing nine companies that enjoy below-market rents and coaching. At Bard, 25 percent of students walk in off the street, 25 percent come from other academic programs at the University of Colorado, and 50 percent come from the UC-Denver business school. Unlike a Small Business Development Center (SBDC) or the Denver Downtown Partnership, however, Bard has longer timeframes, a graduate-level curriculum, incubator space, business plan classes, venture capital, and a business plan competition. The local community supports the business plan competition, often through cash prizes from Denver business leaders or the donation of in-kind services. Bard's incubator hosts firms focused on public relations, telecommunications, executive recruiting, biotechnology, and education. A periodic Meet

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<sup>145</sup> Bernthal Interview, *supra* note 1411.

<sup>146</sup> Bernthal Interview, *supra* note 141.

Up involving alumni, students, and faculty occurs in different locations to foster networking, regardless of the industry focus of that particular location.<sup>147</sup>

## 6. UCCS

The office of UCCS Chancellor Pamela Shockley-Zallabak recently released the Southern Colorado Innovation Strategy (SCIS). The SCIS provides for a campus-driven economic development initiative that engages the Colorado Springs community with on-campus innovation and entrepreneurship. In particular, the SCIS calls for program diversification, enhanced technology transfer, community and regional partnerships, the construction of a research park, and mutually beneficial relationships with the nearby US Northern Command and US Air Force Academy. Under the SCIS, UCCS intends to increase its annual flow of research dollars to \$50 million and to spin off companies at a rate of two per year.

The El Pomar Institute for Innovation and Commercialization (EPIIC) at UCCS works with the CU TTO and the UCCS Office of Sponsored Programs to facilitate the commercialization of student and faculty ideas.<sup>148</sup> EPIIC has three chairs at UCCS, including the El Pomar Chair of Innovation and Security, the El Pomar Chair of Engineering and Innovation, and the El Pomar Chair of Business and Entrepreneurship. EPIIC supports entrepreneurs with a venture capital fund, assistance with SBIR grant applications, prototype development, seminars on applying for SBIR/STTR funds, and community engagement. EPIIC also works with the UCCS College of Business, which hosts the Colorado Springs Small Business Development Center and a center for entrepreneurship.

UCCS offers a trademarked “Bachelor of Innovation” (BI) program co-sponsored by the College of Business and the College of Engineering and Applied Science. The BI program involves a common core curriculum on entrepreneurship and innovation, as well as a long-term multidisciplinary team experience that places students on real projects for companies in the community. BI students can major in business, computer science, computer science security, electrical engineering, and game design and development.

## 7. Other campus units

The Alliance for Technology, Learning, and Society (ATLAS) at CU Boulder collaborates with other CU Boulder entities on entrepreneurship programs, offering space for events and additional support for activities across campus. ATLAS will soon begin to offer a master’s degree in Arts, Media, and Entrepreneurship.<sup>149</sup> Students will complete the MS-AME by taking 10 approved graduate courses, plus a practicum. In consultation with an AME graduate advisor, each student will develop and seek approval for a course plan that matches their particular interests and background. Students pursuing the MS-AME will also be required to complete six approved hours of coursework representing an internship, practicum, research, or creative project.

The Entrepreneurship Center for Music at CU-Boulder provides training in communication, business, and technical skills to music students and professional musicians, all within the context of

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<sup>147</sup> University of Colorado at Denver, Bioscience Program  
[http://thunder1.cudenver.edu/bard/bioscience\\_program.htm](http://thunder1.cudenver.edu/bard/bioscience_program.htm) (last visted Dec. 16, 2008).

<sup>148</sup> El Pomar Institution for Innovation and Commercialization, Technology Transfer,  
<http://epiic.uccs.edu/epiic/techtransfer.php> (last visited Oct. 6, 2008).

<sup>149</sup> Alliance for Technology, Learning, & Society, About Us, <http://is.gd/vGPL> (last visited Oct. 6, 2008).

a global music market. Offerings include condensed workshops, internships, and courses for credit. From the basics of marketing to the application of talent and training, the goal is to foster an entrepreneurial spirit and skills that yield a competitive advantage. With the Center as a catalyst, music students and professionals alike can approach their career more resourcefully, capable of creating successful opportunities that allow them to excel and prosper in their art.

Finally, collaborations between companies in the Colorado Science and Technology Park at Fitzsimons and researchers at UC-Denver Anschutz Medical Campus foster cutting-edge work in biotechnology. Thanks in part to the University of Colorado's involvement in Fitzsimons, Colorado now has 16,000 workers working for 400 companies in the bioscience industry, many of them clustered around CU's campuses in Denver, Boulder, and Colorado Springs. Together, UC-Denver and CU-Boulder account for more than \$500 million in research funding and 93 percent of the 83 companies created by CU in the past 15 years, 68 percent of which focus on biotechnology.

## *B. Colorado State University*

### 1. Education

The Business and Agriculture Colleges at CSU's Fort Collins campus and the Malik Seeme Hasan School of Business at CSU's Pueblo campus both offer entrepreneurship classes.<sup>150</sup> The Center for Entrepreneurship in Fort Collins offers an undergraduate certificate in entrepreneurship, a master's program in entrepreneurship, and also runs an annual undergraduate business plan competition called "*Venture Adventure*."<sup>151</sup> In 2007, the College of Business made sustainable enterprise development central to its mission when it launched the Global Social & Sustainable Enterprise Program (GSSE), a specialized MSBA that takes 25 students per year (half domestic and half international). The GSSE trains students in sustainable entrepreneurship in part through an intensive practicum—often completed overseas—focused on building ventures that serve people and the planet while maintaining profitability.<sup>152</sup> The GSSE is building a national reputation for excellence thanks to experiential programming and several successful student enterprises, including Small Engines for Economic Development (SEED) and PowerMundo. The GSSE program partners with other campus entities, CSU's Engines and Energy Conversion Laboratory, to leverage cutting edge technology for student ventures.

Undergraduates at CSU in Fort Collins started the Collegiate Entrepreneurship Organization, a club for aspiring undergraduate entrepreneurs, while the business school plans to add three to four faculty members per year that focus their scholarship on entrepreneurship.<sup>153</sup> Outside of the College of Business, a number of students and faculty conduct laboratory research with significant commercial potential.<sup>154</sup> Indeed, CSU has experienced revolutionary changes in organizational structure as a result of CSU's efforts to improve research and commercialization.<sup>155</sup>

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<sup>150</sup>Malik & Seeme Hasan School of Business at Colorado State University-Pueblo, Malik & Seeme Hasan School of Business, <http://hsb.colostate-pueblo.edu/> (last visited Oct. 6, 2008); Colorado State University, College of Business, <http://www.biz.colostate.edu/> (last visited Oct. 6, 2008).

<sup>151</sup> Nowak Interview, *supra* note 10.

<sup>152</sup> Colorado State University College of Business, Global Social & Sustainable Enterprise, <http://www.biz.colostate.edu/ms/gsse/> (last visited Jan. 1, 2008).

<sup>153</sup> Nowak Interview, *supra* note 10.

<sup>154</sup> Press Release, Colorado State University, Colorado State University Breaks Ground on Research Innovation Center, Biotech Business Incubator on Foothills Campus (Dec. 9, 2008), *available at*

## 2. Commercialization

CSU developed close ties with industry and government as part of an overall strategy that extends beyond licensing and into full-blown commercialization.<sup>156</sup> The strategy builds upon the \$300 million that already funds research at CSU, as well as existing resources in Colorado.<sup>157</sup> The recently-formed Office of Economic Development widens the pipeline between CSU and outside companies by facilitating sponsored research and public-private partnerships.<sup>158</sup> CSU Ventures, Inc., a non-profit affiliate of CSU, houses the “Supercluster™” initiative, an enhanced business development effort that has helped to forge global R&D and commercialization partnerships, to assist start-ups to mature and roll out new products and services based on the innovations created within CSU’s laboratories, and to streamline the process by which the business community accesses the university, its vast research competencies/capabilities and resources, and intellectual capital. These business enterprises currently focus on infectious disease (MicroRx™), cancer (NeoTRES™), and clean energy and the environment (Cenergy™). Each is led by a seasoned business executive with a deep knowledge of the relevant industry, product landscape, and market needs. CSU and its affiliate organizations also work closely with the regional incubator, the Rocky Mountain Innovation Institute (RMI<sup>2</sup>), a community-based start-up accelerator in northern Colorado.<sup>159</sup>

CSU’s Superclusters engage researchers with industry and government to address great global challenges.<sup>160</sup> Those challenges are selected based upon CSU’s areas of expertise and whether addressing them can support both higher education and higher growth at CSU.<sup>161</sup> While other universities might foster stronger relationships between a single department and a single industry, CSU examined the entire enterprise and looked beyond near-term rewards.<sup>162</sup> Researchers in each Supercluster collaborate with business development professionals, attorneys, representatives from the CSU Foundation, public relations specialists, technology transfer officers, and even representatives from other states to take innovations from labs and to the marketplace, all with the recognition that most global challenges are multidisciplinary, involving international law and infrastructure.<sup>163</sup>

CSU realized early on that the success of the Superclusters™ would depend upon the faculty.<sup>164</sup> Administrators assured the faculty that the Supercluster™ concept was voluntary and re-wrote policies to encourage more commercial activity.<sup>165</sup> CSU also began to hold broader-based research colloquiums to network faculty together without extra funding, and also holds a series of seminars

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[http://newsinfo.colostate.edu/index.asp?url=news\\_item\\_display&news\\_item\\_id=542286310](http://newsinfo.colostate.edu/index.asp?url=news_item_display&news_item_id=542286310) [hereinafter, CSU RIC Press Release].

<sup>155</sup> Jason Kosena, *CSU Works to Turn Being Green into Profit*, COLO. INDEPENDENT, Sept. 17, 2008, available at <http://coloradoindependent.com/8447/csus-efforts-to-turn-green-into-profit-costs-students-plenty>.

<sup>156</sup> Kosena, *supra* note 1555; CU TTO Interview, *supra* note 71.

<sup>157</sup> Nowak Interview, *supra* note 10; Graff Interview, *supra* note 38.

<sup>158</sup> Nowak Interview, *supra* note 10; Wdowik Interview, *supra* note 27; Lambert Interview, *supra* note 10.

<sup>159</sup> Nowak Interview, *supra* note 10; Wdowik Interview, *supra* note 27; Lambert Interview, *supra* note 10.

<sup>160</sup> Lambert Interview, *supra* note 10.

<sup>161</sup> Wdowik Interview, *supra* note 27; Graff Interview, *supra* note 38.

<sup>162</sup> Wdowik Interview, *supra* note 27; CU TTO Interview, *supra* note 71; Marler Interview, *supra* note 23; Lambert Interview, *supra* note 10.

<sup>163</sup> CU TTO Interview, *supra* note 71; Wdowik Interview, *supra* note 27; Lambert Interview, *supra* note 10.

<sup>164</sup> Nowak Interview, *supra* note 10.

<sup>165</sup> Lambert Interview, *supra* note 10.

in February called “Innovation Month” designed to help educate faculty, students and the community about business concepts.<sup>166</sup>

The Colorado State University Research Foundation (CSURF), another affiliated non-profit and parent of CSU Ventures, houses the technology transfer operation and handles real estate and other asset management on behalf of the university.<sup>167</sup> All three entities work with financiers, service providers, and incubators to form strategic partnerships, license technologies, attract funds, and either build divisions of existing companies or create entirely new businesses.<sup>168</sup>

Students are engaged at every level of entrepreneurship, including technology transfer and marketing, start-up creation, business development, and operations. CSU created approximately 20 new companies over the past decade that collectively raised \$200M in private equity, \$75M in government contracts and grants, and created approximately 500 new jobs.<sup>169</sup> For CSU, over 400 new inventions were disclosed over the past 5 years, resulting in about 100 new licenses.<sup>170</sup>

CSU recently broke ground on a \$53 million, 72,000 square foot Research Innovation Center that will include a bioscience business incubator on its third floor.<sup>171</sup> Likewise, within the College of Engineering, the Engines and Energy Conversion Laboratory (EECL) is home to many industry partnerships and houses several clean energy start-up companies. Both will work closely with the city of Fort Collins, RMI<sup>2</sup> and its business advisory group called SAGE, and other regional partners to implement a continuum of mentoring and services for young, high growth companies in the northern Colorado region.<sup>172</sup>

Finally, CSU launched a new for-profit seed and early stage investment fund called “CSU Fund I, LLC”.<sup>173</sup> Geared toward direct ROI investments into CSU start-ups, licensees, research partners, strategic partners and joint ventures, the multi-million dollar fund expects to hold its initial close sometime in 2009.<sup>174</sup>

### *C. Colorado School of Mines*

Hiring practices, culture, and funding composition support an active tradition of interaction between Mines faculty members and industry players. In terms of entrepreneurship education at Mines, “the only education that matters is for students to see their professors have a successful start-up.” According to the Vice President of Research and Technology Transfer at Mines, “if you don’t have top-flight faculty and top-flights students in the hard core disciplines, nothing else will follow.” Mines therefore tries to hire and retain entrepreneurial professors, who in turn attract the right graduate students, who themselves become industry leaders and donate to the institution.

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<sup>166</sup> Lambert Interview, *supra* note 10; Nowak Interview, *supra* note 10.

<sup>167</sup> Kosenka, *supra* note 155; Wdowik Interview, *supra* note 27.

<sup>168</sup> *Id.*; Wdowik Interview, *supra* note 27.

<sup>169</sup> Wdowik Interview, *supra* note 27.

<sup>170</sup> Wdowik Interview, *supra* note 27. Examples of recent CSU successes include Abound Solar, which raised about \$150M in private equity since its inception, Solix Biofuels, which closed on a recent \$15M round and has started a demonstration project near Durango for a full scale production facility, EnviroFit International, Prieto Battery, Inc., and XUV, Inc.<sup>170</sup>

<sup>171</sup> CSU RIC Press Release. *supra* note 154.

<sup>172</sup> Wdowik Interview, *supra* note 27.

<sup>173</sup> Wdowik Interview, *supra* note 27.

<sup>174</sup> Wdowik Interview, *supra* note 27.

Once the right people are in place, Mines supports them. Mines raises private funds for technology transfer, since the only public funds available come from the Colorado Renewable Energy Collaboratory and other select legislation. Mines conducts more industry-sponsored applied research than other Colorado institutions, with more than 50% of its funding drawn from private companies, many run by alumni. Mines avoids incubators, however, preferring to establish research institutes in partnership with larger companies that bring along their own incubation functions. But because so much commercial activity occurs around campus, Mines developed policies that govern university entrepreneurship: start-ups run by professors or laboratories must be “clean” and off campus; students must work for an entity, not a professor; and students may not work for their advisors or members of a dissertation review committee. In addition, Mines hosts two federal labs, serves on the NREL board, maintains a role on the Alliance for Sustainable Colorado, has strong ties with NCAR, works closely with NIST through faculty collaborations, and has a number of graduate students receiving academic credit for their work the federal labs.

The right people and the right support yield a robust technology transfer program. In partnership with the Jefferson County Economic Development Council, Mines TTO has built trust with faculty members through education and procedures that determine when innovations have commercial value. Mines TTO works hard to manage expectations with faculty and administrators, however, given the amount of money required for commercialization and the structure of equity in involved in profitable spin-offs. Notably, MicroPhage, Metafluidics Inc., and NanoThread Inc. all grew out of research conducted at Mines.<sup>175</sup>

#### *D. University of Denver*

DU offers classes and projects focused upon entrepreneurship, including classes held at the Daniels College of Business. One particularly notable DU initiative involves a certificate program in entrepreneurial studies at DU’s Women’s College. The Women’s College occupies a unique position with respect to existing and aspiring female entrepreneurs. According to a 2006 survey conducted by the Center for Women’s Business Research, the Denver area is among the top rated metropolitan cities with the best environment for women entrepreneurs.<sup>176</sup> But while women are a significant and growing part of entrepreneurship, many have not reached significant benchmarks or indicators of success.<sup>177</sup> Indeed, only three percent of women break through the million-dollar annual revenue benchmark.<sup>178</sup> To help women grow and sustain their businesses, the Women’s College worked with the Daniels College of Business to launch an undergraduate, cross-disciplinary certificate program in entrepreneurial studies. Through the certificate program, DU hopes to

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<sup>175</sup> *New Technology Transfer Advisory Board*, MINES: COLO. SCHOOL OF MINES MAG., Nov. 2007, at 10, [http://www.alumnifriends.mines.edu/Alumni/mag\\_features\\_200703/vol\\_97\\_num1.pdf](http://www.alumnifriends.mines.edu/Alumni/mag_features_200703/vol_97_num1.pdf).

<sup>176</sup> Center for Women’s Business Research, *available at* <http://www.nfwbo.org/content/index.php?pid=102>, (last visited July 10, 2009). *See also*, Matthew Bandyk, *The 7 Best States to Start a Business: Ranking the States Based on how Friendly they are to Entrepreneurs*, U.S. NEWS & WORLD RPT., Jan. 6, 2009, (rating the Metro-Denver area as third in the nation for the best environment in which to cultivate entrepreneurs).

<sup>177</sup> Kauffman Firm Survey (KFS) Studies, *Characteristics of New Firms: A Comparison by Gender 2* (Jan. 2009), [http://www.kauffman.org/uploadedfiles/kfs\\_gender\\_020209.pdf](http://www.kauffman.org/uploadedfiles/kfs_gender_020209.pdf).

<sup>178</sup> Center for Women’s Business Research, *Key Facts*, *available at* <http://www.womensbusinessresearchcenter.org/research/keyfacts/> (last visited July 10, 2009.)



contribute meaningfully to economic development, particularly for women of color, in the Metro-Denver area and throughout Colorado.

*E. Metro State College*

Three years ago, the President of Metro State College founded the Center for Innovation by agreeing to provide \$250 thousand per year for five years until the Center could become self-sufficient. Today, the Center maintains relationships with partners at Metro State and in Denver, including the Denver Economic Development Office. The Center is also working with the Denver Venture School, the newest charter school in Denver and the first charter school in the nation focused upon fostering innovation. Center Director Mick Jackowski has also established a seed program that funds faculty efforts to design entrepreneurially-focused courses. Unlike similar offerings in Colorado, the Center for Innovation focuses exclusively on underserved urban communities and non-profit entrepreneurship. Moreover, as an independent unit of Metro State, the Center for Innovation does not require students to complete prerequisites before enrolling in entrepreneurship classes. Indeed, the Center deliberately avoids offering certificates and majors so that major requirements will not impede access to entrepreneurship education. As a result, a social entrepreneurship class maxed out its enrollment in the first year of the offering.

*F. United States Air Force Academy*

Cadets in Technological Innovation Management, a two-semester course offered to juniors at the United States Air Force Academy (USAFA), learn about the role of entrepreneurship in organizations and societies. The syllabus combines elements of technology venture courses offered by schools of engineering with elements of entrepreneurship classes offered by schools of business. After completing core requirements in finance or engineering, the 70 cadets in the first semester class learn to recognize, analyze, and exploit opportunities through a combination of experiential learning, classroom lectures, and in-class exercises. In the classroom, cadets work through public and private business cases while enjoying entrepreneurial guest lecturers, including an alumnus who now builds systems for the CIA and the NSA. Outside of the classroom, cadets conduct feasibility studies through the USAFA's Innovation Center. Cadets with the best feasibility studies are then allowed to enroll in a second semester of the course, where they develop their projects into commercially viable innovations. Because the academy lacks monetary support for multiple projects, however, the academy limits enrollment in the class.

Because the USAFA prepares cadets to serve in the Air Force, however, entrepreneurship classes do not prepare students to start companies after they graduate. Rather, students work on projects, programs, or products that may be of use to the USAFA, or even the U.S. military as a whole, with the goal of producing better officers. The core idea is to focus on technologies and mindsets, encouraging cadets to observe problems and to solve them.

Like non-military, public, research universities, the USAFA also commercializes innovations. The USAFA's Center for Research helps scientists and engineers to apply for grants, and innovations work their way into markets, including an ionic fluids technology developed by USAFA Chemistry Professor John S. Wilkes. In addition, a 501(c)(3) organization called FalconWorks houses

interdisciplinary teams of cadets who work on senior capstone projects focused on innovations for special needs children.<sup>179</sup>

### G. Federal Laboratories

The United States Geological Survey (USGS), the University Corporation for Atmospheric Research (UCAR), the National Renewable Energy Laboratory (NREL), the National Institute for Standards and Technology (NIST), and the National Oceanic and Atmospheric Administration (NOAA) account for 80 percent of the net economic benefits contributed to the local economy by Colorado's 14 federal labs.<sup>180</sup> Though smaller, the Institute for Telecommunications Sciences at the Boulder campus of the National Telecommunications & Information Administration also plays a critical role in the development of critical technology standards for both telecommunications and smart grid. The labs also provide higher education in the form of research fellowships, post-doctoral programs, internships, work-study positions, and research assistantships.<sup>181</sup> Human capital from the labs often works its way into the Colorado economy, fertilizing new companies with high-quality employees and their ideas.<sup>182</sup> NREL, one of a handful of research facilities focused on renewable energy, also works to commercialize scientific discoveries under a new commercialization mandate.<sup>183</sup>

The Front Range research universities and the Front Range federal laboratories enjoy a semi-symbiotic relationship.<sup>184</sup> The institutions maintain research alliances with one another and with industry, leading to the creation and transfer of technologies, a variety of different commercial spin-offs, and even Nobel Prizes.<sup>185</sup> Where federal law prevents federal laboratories from conducting certain types of research, university researchers and industry labs can and do fill gaps.<sup>186</sup> At NREL, a newly-formed Commercialization and Deployment Center engages venture capitalists in commercializing research, while an emerging Market Data Resource Center seek to resolve economic issues that prevent innovations from getting to market.<sup>187</sup>

### III. CHALLENGES AND OPPORTUNITIES

Highly-educated people produce innovations that drive employment, sales, profitability, economic growth, and standards of living.<sup>188</sup> But economic development initiatives tend to focus on a certain subset of small businesses.<sup>189</sup> As a result, the entrepreneurs who produce the majority of growth

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<sup>179</sup> FalconWorks, <http://www.falconworks.org> (last visited Nov. 19, 2008).

<sup>180</sup> CO-LABS, *supra* note 122, at 3.

<sup>181</sup> CO-LABS, *supra* note 122, at 4.

<sup>182</sup> CU TTO Interview, *supra* note 71.

<sup>183</sup> Interview with Alison Wise, Senior Strategic Analyst, Commercialization & Deployment Center, National Renewable Energy Laboratory (Dec. 1, 2008) [hereinafter Wise Interview].

<sup>184</sup> CU TTO Interview, *supra* note 71; Wise Interview, *supra* note 183.

<sup>185</sup> CO-LABS, *supra* note 122, at 4.

<sup>186</sup> CU TTO Interview, *supra* note 71.

<sup>187</sup> Wise Interview, *supra* note 183.

<sup>188</sup> Galama & Hosek, *supra* note 79, at 7.

<sup>189</sup> Audretsch, *supra* note 4, at 2; SMALL BUSINESS ADMINISTRATION, *supra* note 36, at iii (2007); SMALL BUSINESS ADMINISTRATION OFFICE OF ADVOCACY, FREQUENTLY ASKED QUESTIONS 1 (2008); Scott Shane, *The Start-Ups We Don't Need*, THE AMERICAN, Jan. 7, 2009.

can fall between the cracks.<sup>190</sup> Indeed, Colorado only recently began to recognize and support institutions of higher education and federal laboratories in their efforts to foster innovation-driven growth.<sup>191</sup> If higher education is the engine of the Colorado economy, policymakers should do more to support higher education in its efforts to support entrepreneurs and innovation.<sup>192</sup> The first section of this Part III suggests high-level strategic considerations for Colorado. Following that, the balance of Part III highlights the initiatives and recommendations identified by discussants at a June 24, 2009 Roundtable.

### A. *Strategic Considerations*

To enhance entrepreneurial growth, Colorado must examine its entrepreneurial capabilities, R&D and technology, culture, access to finance, and regulations. In terms of entrepreneurial capabilities, outside of information and communications technologies, some experts believe that Colorado lacks venture-ready CEOs who have the training and experience necessary to take innovations from the laboratory to the marketplace.<sup>193</sup> With respect to R&D and technology, excluding Mines, Colorado's researchers tend to gravitate towards federal research dollars and avoid commercially-funded research, while TTOs do not maximize the number of spin-offs due to capital constraints and shorter time horizons.<sup>194</sup> As for culture, CU professors joke about being able to spend 20% of their time on commercialization . . . so long as that time occurs on weekends and holidays, while CSU professors deride efforts to increase interactions with industry;<sup>195</sup> successful academic entrepreneurs receive limited attention, while those incapable or unwilling to engage in commercial pursuits exhibit a semi-allergic reaction to entrepreneurship, viewing start-ups as a distraction from pursuing tenure.<sup>196</sup>

While it is tempting to suggest that Colorado's federal laboratories and institutions of higher education can enhance entrepreneurship by copying strategies from other locales, academic research leads to a different conclusion.<sup>197</sup> The latest scholarship on entrepreneurship, innovation, and higher education suggests that:

- Highly-educated people produce more high-growth firms;<sup>198</sup>

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<sup>190</sup> NGA CENTER FOR BEST PRACTICES, A GOVERNOR'S GUIDE TO STRENGTHENING STATE ENTREPRENEURSHIP POLICY 4-9 (2004).

<sup>191</sup> Interview with Dr. Catherine Kunst, Executive Director, Bard Center for Entrepreneurship (Oct. 23, 2008) [hereinafter Kunst Interview]; Meyers Interview, *supra* note 80; Nowak Interview, *supra* note 10; Lambert Interview, *supra* note 10.

<sup>192</sup> See BILL RITTER FOR GOVERNOR 2006, THE COLORADO PROMISE 9; Scott Shane, *Introduction*, in ECONOMIC DEVELOPMENT THROUGH ENTREPRENEURSHIP 1 (Scott Shane, ed., 2005); Acs, et al., *supra* note 7, at 12.

<sup>193</sup> CU TTO Interview, *supra* note 71; Lambert Interview, *supra* note 10; Kunst Interview, *supra* note 191; Meyers Interview, *supra* note 80; Nowak Interview, *supra* note 10; Appendix A.

<sup>194</sup> See CBSA 2008 ROADMAP, *supra* note 40, at ES-8; Feld Interview, *supra* note 106; Appendix A.

<sup>195</sup> Feld Interview, *supra* note 106; Jerde Interview, *supra* note 11; Lookabaugh Interview, *supra* note 81; Smith Interview, *supra* note 81; Appendix A; CU TTO Interview, *supra* note 71.

<sup>196</sup> Bernthal Interview, *supra* note 141; Feld Interview, *supra* note 106; Lookabaugh Interview, *supra* note 81; CU TTO Interview, *supra* note 71; Lambert Interview, *supra* note 10.

<sup>197</sup> Pittaway & Cope, *supra* note 67, at 493; SCOTT SHANE, ECONOMIC DEVELOPMENT THROUGH ENTREPRENEURSHIP 25 (2005).

<sup>198</sup> See SHANE, *supra* note 19, at 24.

- People tend to start businesses in their 40s in familiar industry sectors;<sup>199</sup>
- The indicators most closely linked with economic growth involve educational attainment and patents per capita;<sup>200</sup>
- Higher education may foster anti-commercial attitudes;<sup>201</sup>
- More evidence is needed to determine whether entrepreneurship education (in its current form) is positively linked to increased high-growth entrepreneurship;<sup>202</sup>
- Networks are positively correlated with innovation, financial performance, and job performance;<sup>203</sup> and
- Increased pools of capital do not increase new firm creation, whereas improved deal flows tend to attract venture capital.<sup>204</sup>

Together, these findings suggest that Colorado should recognize and support highly-educated people who have already graduated from college and help them to start businesses in industries known for high growth and high barriers to entry.

Given that increasing age seems to be among the best predictors of successful self-employment, and that older people are less likely to leave Colorado upon graduation, it makes sense for Colorado universities and governments to increase their focus on opportunities and support for highly-educated entrepreneurs with significant industry experience.<sup>205</sup> Other states concentrate on “[t]he human capital of the founder and his motivations, the industries in which companies are founded, their business ideas and strategies, their legal forms and capital structure[.]”<sup>206</sup> Colorado colleges and universities should seek to hire university administrators with industry experience who can serve as mentors to academic entrepreneurs while working to create an environment in which professors can pursue commercial endeavors without fear of penalty.<sup>207</sup> Entrepreneurship educators should also continue to work with technology transfer offices to educate faculty and the community on the value of commercialization, both financially and scholastically, while expanding relationships with the federal research labs and local incubators.<sup>208</sup> Between all of these activities, however, universities need brokers (or advisors) that can tie all of the pieces together and act in an advisory capacity, perhaps around different clusters, and proceed in a strategic fashion.<sup>209</sup> The

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<sup>199</sup> SHANE, *supra* note 19, 4-5.

<sup>200</sup> Reauthorization of the Small Business Innovation Research Programs and “Unleashing American Innovation”: Before the Subcomm. on Tech. & Innovation of the H. Comm. on Sci. & Tech., 110<sup>th</sup> Cong., 5 (Apr. 26, 2007) (Testimony of Robert N. Schmidt, Founder and President, Cleveland Medical Devices ,Inc.).

<sup>201</sup> Mike Wright, et al., *Returnee Entrepreneurs, Science Park Location Choice and Performance: An Analysis of High Technology SMEs in China*, ENTREPRENEURSHIP THEORY & PRAC., Jan. 2008, at 135-36.

<sup>202</sup> Vangelis Souitaris, et al., *Do Entrepreneurship Programs Raise Entrepreneurial Intention of Science and Engineering Students? The Effect of Learning, Inspiration and Resources*, 22 J. OF BUS. VENTURING 556, 587 (2007).

<sup>203</sup> Vincent & Bharadwaj, *supra* note 45, at 7.

<sup>204</sup> SHANE, *supra* note 19, at 28.

<sup>205</sup> Shane, *supra* note 7; Acs, et al., *supra* note 7, at 8.

<sup>206</sup> Shane, *supra* note 7.

<sup>207</sup> Feld Interview, *supra* note 106; Appendix A; Jerde Interview, *supra* note 11; Bernthal Interview, *supra* note 141; Interview with Robert Witoff, CTO, Chalk2Me (Oct. 16, 2008).

<sup>208</sup> Smith Interview, *supra* note 81.

<sup>209</sup> CU TTO Interview, *supra* note 71.

ultimate goal is to improve the pipeline of innovations and start-ups.<sup>210</sup> After all, if high-growth entrepreneurship is the primary source of quality jobs and regional investment—and it is—then failure to identify and support high-growth entrepreneurship is “an unacceptable policy choice.”<sup>211</sup>

To get students working in the right industries, the university-industry interface can create reciprocal relationships with companies, giving businesses a conduit to high-quality students and academic ideas in exchange for funding and other forms of support, such as guest lectures and student internships, all with the ultimate objective of providing the best education to students.<sup>212</sup> Programs modeled after the Chalmers School of Entrepreneurship in Sweden and the TI:GER program in Georgia could give students real-world, experiential learning opportunities without pulling professors or students away from existing departments.<sup>213</sup> Senior projects or graduate theses could serve as commercialization vehicles, and universities could provide incentives for professors to infuse more applied science into projects or to place students with local companies where their ideas can be tested.<sup>214</sup> Again, the ultimate goal would be to improve the pipeline and not just to produce more firms.<sup>215</sup> Silicon Valley is below average in terms of start-ups and self-employment rates, so the central idea must be to enhance wealth.<sup>216</sup>

#### *B. Initiatives and Recommendations for Colorado Universities<sup>217</sup>*

A group of Colorado leaders involved in higher education and entrepreneurship met on June 24, 2009. A draft of this Report was provided to the participants in advance of the meeting. The June 24 meeting analyzed issues salient to the Report and suggested next steps which could follow its issuance. While no formal vote concerning formal adoption of the Report occurred on behalf of the group, the Roundtable participants collectively identified three general initiatives and, additionally, three specific steps that Colorado universities should undertake to obtain entrepreneurship objectives. These are summarized below. A Memorandum summarizing the June 24 meeting is attached as Appendix C.

The three general objectives identified included: (1) raising awareness concerning the extensive range of existing entrepreneurship initiatives at colleges and universities; (2) facilitating sensible collaboration (e.g., grant writing) and information sharing among Colorado’s higher educational institutions; and (3) establishing a pan-university entrepreneurial forum or network that would facilitate the first two initiatives and weigh in on policy issues that affect entrepreneurial education.

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<sup>210</sup> Smith Interview, *supra* note 81; Bernthal Interview, *supra* note 141; Feld Interview, *supra* note 106.

<sup>211</sup> See National Commission on Entrepreneurship, *Embracing Innovation: Entrepreneurship and American Economic Growth* 10 (Apr. 2000).

<sup>212</sup> Smith Interview, *supra* note 81.

<sup>213</sup> Feld Interview, *supra* note 106; Graff Interview, *supra* note 38; Lookabaugh Interview, *supra* note 81; Appendix A.

<sup>214</sup> *Id.*; Bernthal Interview, *supra* note 141.

<sup>215</sup> See Smith Interview, *supra* note 81; Bernthal Interview, *supra* note 141; Feld Interview, *supra* note 106.

<sup>216</sup> SHANE, *supra* note 19, at 21-23; see DAVID A. HARPER, *FOUNDATIONS OF ENTREPRENEURSHIP AND ECONOMIC DEVELOPMENT* 175 (2003).

<sup>217</sup> See Memorandum Summarizing June 24, 2009 Roundtable, which has been incorporated herein as Appendix C.

To implement these initiatives, the Roundtable participants identified three specific recommendations:

1. Create an Entrepreneurship Education Clearinghouse to aid people outside the university in identifying programs and opportunities available within the university system. The Clearinghouse would help provide direction, where appropriate, concerning how to access research labs, professors, and student talent.
2. In lieu of a Clearinghouse, a less resource-intensive awareness drive could provide information to the entrepreneurship community concerning the range of existing offerings and resources at Colorado's universities.
3. Establish a pan-campus policy forum for continued discussion of entrepreneurial initiatives among and between universities, to be accomplished through a commitment to regular in-person and phone-in meetings and supported by the use of email or social network programs.

#### CONCLUSION

This Report focuses on university support and education for entrepreneurs in Colorado. To place these matters in perspective, however, consider Professor Marvin Caruthers. In 1979, fresh from post-doctoral studies at the Massachusetts Institute of Technology, Caruthers joined the faculty of the University of Colorado with appointments in the departments of chemistry and biochemistry. One year later, Caruthers co-founded AMGen and helped to grow it into the world's largest biotechnology company. A recipient of the National Medal of Science and the owner of several patents, Dr. Caruthers continues to start biotechnology companies while teaching and conducting research in Boulder.

Consider also Angelina Pramatarova. In 2007, Pramatarova left the Ministry of Economy and Energy of Bulgaria to enroll in the Global Social and Sustainable Enterprise Program at Colorado State University. As part of her studies, Pramatarova and three other CSU students wrote a business plan for a company that would use technologies developed in CSU's Engine Laboratory in the developing world. The four co-founders also conducted market research in the developing world and raised \$35,000 of start-up capital through business plan competitions and other fundraising activities. Their business, Small Engines for Economic Development, now sells irrigation engines and pump sets throughout the developing world.

For every Dr. Caruthers or Ms. Pramatarova, however, there are many more failed entrepreneurs. Only a tiny fraction of academic entrepreneurs succeed in business, let alone work within an institutional environment that supports their efforts. But universities are the intellectual and economic hubs of the American economy and play a critical role in economic growth.<sup>218</sup> Indeed, almost all of the leading creative regions in the nation all have one or more great universities.<sup>219</sup> As

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<sup>218</sup> FLORIDA, *supra* note 3, at 251 (2005); Andrew Nelson & Thomas Byers, *Organizational Modularity and Intra-University Relationships between Entrepreneurship Education and Technology Transfer* 2 (2005).

<sup>219</sup> FLORIDA, *supra* note 3, at 251.

such, it is incumbent upon Colorado to ensure that its universities become a more welcoming environment for commercial activity and entrepreneurship.

## APPENDIX A—ROUNDTABLE NOTES

The Silicon Flatirons Center hosted a panel discussion on December 11, 2008 that included the following individuals:

- Entrepreneurship Centers
  - J. Brad Bernthal  
Director, Entrepreneurship Initiative, Silicon Flatirons Center, University of Colorado
  - Alex (Sandy) Bracken  
Former Executive Director, Bard Center for Entrepreneurship, University of Colorado
  - Dr. Mick Jackowski  
Executive Director, Center for Innovation, Metro State College
  - Dr. Catherine Kunst  
Executive Director, Bard Center for Entrepreneurship, University of Colorado
  - Dr. Stephen Lawrence  
Academic Director, Deming Center for Entrepreneurship, University of Colorado
  - Henry Nowak  
Director, CSU Center for Entrepreneurship
  - Kurt Smith  
Director, Engineering and Entrepreneurship Program, University of Colorado  
Founder, Surgical Navigation Technologies
- Technology Transfer
  - Dr. David Allen  
Associate Vice President, University of Colorado Technology Transfer Office
  - Todd Headley  
Director, Technology Transfer Office, Colorado State University Research Foundation
  - Kate Tallman  
Director, University of Colorado Technology Transfer Office
  - Dr. Will Vaughan, PhD  
Director, Office of Technology Transfer, Colorado School of Mines
- Professors, Fellows, and Entrepreneurs-in-Residence
  - Dr. Gregory D. Graff  
Assistant Professor, Colorado State University
  - Paul Bauer  
Clinical Professor, Daniels College of Business, University of Denver
  - Frank Moyes  
Entrepreneurship Scholar in Residence, Deming Center for Entrepreneurship
  - Jill Rennert  
Research Fellow, Silicon Flatirons Center, University of Colorado
- Federal Laboratories



- Alison Wise  
Senior Strategic Analyst, Commercialization and Deployment Center, NREL
- Entrepreneurs and Financiers
  - Matthew Emmi  
Founder, One Button
  - Howard Kaushansky  
Founder, Umbria
  - Juan Rodriguez  
Founder, StorageTek
  - Scott Tibbitts  
Founder, Starsys Research Corporation
  - Jason Mendelson  
Managing Director, Foundry Group

Within the panel discussion, the following general comments and concepts emerged. Pursuant to a modified version of the Chatham House Rule, however, the following ideas are not attributed to any single individual or institution.<sup>220</sup>

- Campuses should strive to create a culture with an entrepreneurial orientation for faculty and students.
  - Institutional “passive positive” relationships with faculty who want to be involved in entrepreneurial ventures.
    - Faculty involvement in start-ups does not need to count toward tenure credit. It is important, however, that involvement in a start up or emerging company should not be a strike against a faculty member.
  - “Taster” options for students to get exposed to entrepreneurship. Try to expose students to the rush of a start-up (e.g., participation in a Start-up Weekend or some such event which connects students to the experience around starting a company).
  - Build entrepreneurship into the traditional incentive and reward structure of the university (e.g., credit and courses). Ideally, each discipline will have a class which provides ready pathways to the entrepreneurial community and areas events.
    - At CU-Boulder, Frank Moyes’ business planning course (in the business school), Brad Bernthal’s Entrepreneurial Law Clinic and Venture Capital Course (in the law school), and Kurt Smith’s e-Ship program (in Engineering Management) each alert and provide easy avenues for student entry into networking, intern opportunities, and awareness concerning “who is who” in the community.

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<sup>220</sup> According to the Chatham House Rule, “When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.” Chatham House, About Us: The Chatham House, <http://www.chathamhouse.org.uk/about/chathamhouserule/> (last visited Dec. 7, 2009).

- Ensuring that each discipline has at least one course offering which builds in pathways to the community would facilitate the creation of an entrepreneurial culture.
  - Universities that have become entrepreneurial (MIT, Stanford, etc.) seem to have replaced the notion among faculty that business application sullies the pursuit of knowledge with the notion that each faculty member will of course have attempted one or more business application of their work, usually through a start-up. This is the foundation that moves beyond the “one course” starting point to entrepreneurship (in the broader sense) being interwoven throughout the curriculum.
  - Teaching entrepreneurship combines teaching entrepreneurial skills with a substantial dose of tangible modeling of entrepreneurs and entrepreneurship for students. The more the students can identify with the models, the better (faculty they know, former students who are now entrepreneurs, applying technologies they are familiar with, etc.)
  - Encourage student participation in existing entrepreneurship programs (ie CU NVC) by allowing participation to count towards grade or somehow providing break in workload during important entrepreneurship events. (or consider allowing more courses without letter grades so that students have more time to spend on extracurricular events that encourage entrepreneurship)
- Train students to identify needs that entrepreneurs can address. Or have the state identify needs that students interested in entrepreneurship can seek to address.
- Encourage communications between the university and industry – listen to what industries are interested in and respond to it. (Help change the culture of knowledge for knowledge sake to have more of a product focus)
- Create a program in entrepreneurship that is equivalent to a medical residency
- Consider stepping away from a “cookie cutter structure” for tenure so that faculty members have greater flexibility to work on entrepreneurial initiatives
- Have more resources committed for encouraging a culture of entrepreneurship (e.g., consider an undergraduate residence hall similar to the one at University of Maryland with an incubator environment – conference rooms, computer labs, appropriate technology, etc.)
- Build greater cohesion between entrepreneurial bodies across a single campus as well as between a university and the surrounding community.
  - Within a campus –
    - Campuses should seek the right amount of federation between entities involved in entrepreneurship. This does not mean centralization or excessive bureaucracy. Rather, federation embraces that entrepreneurship cuts across disciplines and works best when there are flurries of entrepreneurial culture residing in a variety of colleges and departments, ranging from music to business to engineering.



- Educational initiatives are much more successful in securing state support (particularly in the legislature) if business is visibly involved and preferably actually leading the charge.
- Entrepreneurial education has a broader scope than coordinating initiatives within and across universities focused on high technology businesses.
  - Colorado has 17,000 non-profits. Students respond well to opportunities to participate in growing non-profits.
  - Entrepreneurship in non-technical businesses is important and beneficial. In addition, the non-technical sphere is relevant to many students. At CU Boulder, eighty percent of the campus is not concerned with high-technology.
  - Reaching into high schools. (One possibility is to sponsor business plan competitions in high school)
  - Ensuring relevance in rural Colorado and on the West Slope?
  - There may be a specific opportunity to learn from and leverage the federal government's SBIR and STTR programs for funding technology transfer and entrepreneurship ("there is a hunger to fix the SBIR process so that it actually creates small companies").

## APPENDIX B—SURVEY RESULTS

To qualify respondents as Colorado entrepreneurs, two survey questions asked about residency status and how many businesses respondents had founded in which they invested intellectual property or risk capital.<sup>221</sup> Of the 95 entrepreneurs identified, 60% had taken undergraduate- or graduate-level business or engineering classes, 79% were between the ages of 25 and 54, and 68.5% had started two or more businesses. Of the serial entrepreneurs:

- 58.6% took semester-long courses in Business & Engineering skills (“B&E skills”);
- 93.1% did not do an internship with a start-up for college credit;
- 60.3% completed some graduate school or more;
- 84.5% experienced one or more business failures;
- 75.9% focused on information technology;
- 81.0% were born and raised outside of Colorado;
- 58.6% attended college or graduate school in Colorado;
- More than two thirds were between 35 and 54 years of age;
- 75.9% were either within the first 3.5 years of getting a start-up going;
- 72.4% did not hold any patents;
- Asked why universities to be valuable to their businesses, 43.1% wanted to hire professors or students to work at their companies, 34.5% wanted to collaborate with students or professors, and 56.9% considered universities to be a valuable networking tool; and
- 84.5% reported that their businesses had succeeded either in terms of several years of profitability or a liquidation event such as an acquisition, merger, or IPO.

Of the first time entrepreneurs, who comprised about one third of those surveyed:

- 96.4% had not done an internship with a start-up for college credit;
- One third did not do any annual training in B&E skills or engineering;
- 46.4% wanted to take a class in corporate or entrepreneurial finance;
- 53.6% considered universities important to their businesses because of the need for access to networks of peers and mentors, as well as access to potential employees;
- 57.1% reported that their businesses had succeeded either in terms of several years of profitability or a liquidation event such as an acquisition, merger, or IPO;
- 82.1% focused on information or communications technologies; and
- 67.8% were between the ages of 25 and 44.

Of people who had started more than five businesses, none took ongoing classes in B&E skills, while 70% of those who had started two to five businesses reported attending some form of training related to engineering or B&E skills. Of the few bioscience, energy, and renewable energy entrepreneurs represented, 100% reported completing an internship with a start-up or high-

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<sup>221</sup> The survey was shared with participants in the Boulder, CO New Tech and Green Tech meet-ups. The first survey question identified the entrepreneur respondents. Green Tech meet-ups, similar to the New Tech meet-ups discussed on page 15, focus on energy generation, transportation, construction, and efficiency technologies. Colorado Green Tech Group, <http://meetup.com/ColoradoGreenTechMeetup/> (last visited July 9, 2009).

growth business for college credit, and 91% had at least an undergraduate degree. Notably, when asked what course they would take tomorrow, 37.2% selected Corporate or Entrepreneurial Finance.

<b>How many businesses have you founded in which you invested your own risk capital or licensed your own intellectual property?</b>		
	Response Percent	Response Count
One	31.6%	30
<b>Two to Five</b>	<b>65.3%</b>	<b>62</b>
Five to Ten	3.2%	3

<b>Have you taken any classes or other semester-long training in accounting, finance, marketing, business plan preparation, business law, or economics?</b>		
	Response Percent	Response Count
<b>Yes</b>	<b>58.9%</b>	<b>56</b>
No	41.1%	39

<b>How about an internship with a start-up or high-growth business that resulted in college credit?</b>		
	Response Percent	Response Count
Yes	6.3%	6
<b>No</b>	<b>93.7%</b>	<b>89</b>

<b>How much education have you completed?</b>		
	Response Percent	Response Count
High School or GED	2.1%	2
Some college/associate's degree	11.6%	11
<b>Undergraduate degree</b>	<b>30.5%</b>	<b>29</b>
Some graduate school	12.6%	12
<b>Master's degree or equivalent</b>	<b>36.8%</b>	<b>35</b>
Some post-graduate work	3.2%	3
PhD	3.2%	3

<b>On average, how many hours of "entrepreneurship" training do you go through each year? (Training can include classes on engineering, accounting, finance, marketing, sales, business plans, or some other area that you personally consider relevant to your business)</b>		
	Response Percent	Response Count
<b>None</b>	<b>31.6%</b>	<b>30</b>
Less than one hour	4.2%	4
1-2 hours	9.5%	9
3-5 hours	15.8%	15
6-7 hours	2.1%	2
<b>More than 8</b>	<b>36.8%</b>	<b>35</b>

<b>If you could take a class tomorrow in only one of the following areas, which class would be the most useful to you?</b>		
	Response Percent	Response Count
Engineering or Hard Sciences	9.5%	9
Legal or Tax	17.9%	17
Accounting	4.2%	4
<b>Corporate or Entrepreneurial Finance</b>	<b>37.9%</b>	<b>36</b>
Sales	15.8%	15
Other	14.7%	14

<b>Universities are important to my business because I need:</b>		
	Response Percent	Response Count
...nothing. Universities are irrelevant to what I do.	13.7%	13
<b>...to hire students or professors to work at my company</b>	<b>49.5%</b>	<b>47</b>
...to license intellectual property from a technology transfer office or professor	15.8%	15
...to collaborate and consult with professors and graduate students	33.7%	32
<b>...to have access to a network of peers and mentors</b>	<b>55.8%</b>	<b>53</b>
...to have inexpensive office space and access to infrastructure	12.6%	12
...something else	11.6%	11

<b>How many of your businesses have succeeded? (Success can include several years of profitability or a liquidation event such as an acquisition, merger, or IPO)</b>		
	Response Percent	Response Count
None	23.2%	22
<b>One</b>	<b>43.2%</b>	<b>41</b>
Two to five	33.7%	32
I've lost count	0.0%	0

<b>How many of your businesses have failed?</b>		
	Response Percent	Response Count
<b>None</b>	<b>45.3%</b>	<b>43</b>
One	32.6%	31
Two to five	18.9%	18
I've lost count	1.1%	1
None, but I'm on the verge of losing one	2.1%	2



<b>How far away is the nearest university or college from your primary place of business?</b>		
	Response Percent	Response Count
Less than a mile	17.9%	17
1-5 miles	<b>36.8%</b>	<b>35</b>
6-10 miles	26.3%	25
11-15 miles	9.5%	9
Greater than 15 miles	9.5%	9

<b>Which industry do you focus upon?</b>		
	Response Percent	Response Count
Aerospace	0.0%	0
Biotechnology or life sciences	7.4%	7
Energy: oil & gas, renewable, clean technology, etc.	8.4%	8
<b>Information or communications technologies</b>	<b>70.5%</b>	<b>67</b>
Other	13.7%	13

<b>Were you born or raised primarily in Colorado?</b>		
	Response Percent	Response Count
Yes	21.1%	20
<b>No</b>	<b>78.9%</b>	<b>75</b>

<b>Did you attend college or graduate school in Colorado?</b>		
	Response Percent	Response Count
Yes	45.3%	43
<b>No</b>	<b>54.7%</b>	<b>52</b>

<b>Were you born in the United States?</b>		
	Response Percent	Response Count
<b>Yes</b>	<b>90.5%</b>	<b>86</b>
No	9.5%	9

<b>How old are you?</b>		
	Response Percent	Response Count
18-24	7.4%	7
25-34	18.9%	18
<b>35-44</b>	<b>33.7%</b>	<b>32</b>
45-54	26.3%	25
55-64	11.6%	11
64 or older	2.1%	2

<b>Which of the following sentences describes you?</b>		
	Response Percent	Response Count
I do not want to own my own business.	1.1%	1
I am thinking of starting a business, but not currently doing so.	8.4%	8
<b>I am actively involved in setting up a business that I will own or co-own; this business has not paid salaries, wages, or any other payments to myself or other owners for more than 3 months.</b>	<b>35.8%</b>	<b>34</b>
<b>I am an owner or manager of a business that has paid salaries, wages, or any other payments to the owners for LESS THAN 42 months.</b>	<b>35.8%</b>	<b>34</b>
I am an owner or manager of a business that has paid salaries, wages, or any other payments to the owners for MORE than 42 months.	18.9%	18

<b>How many patents list you as an inventor?</b>		
	Response Percent	Response Count
<b>None</b>	<b>72.6%</b>	<b>69</b>
1-5	25.3%	24
6-10	1.1%	1
11-15	0.0%	0
15 or more	1.1%	1

## Appendix C – Memorandum Summarizing June 24, 2009 Roundtable

### M E M O R A N D U M

To: Roundtable Participants  
From: Brad Bernthal, Paul Shoning and Therese Kerfoot, Silicon Flatirons Center  
Cc: Cathy Kunst, Executive Director, Bard Center for Entrepreneurship  
Date: June 30, 2009  
Re: *Summary of June 24 Roundtable on Higher Education & Entrepreneurship in Colorado*

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#### I. INTRODUCTION

On June 24, 2009, Brad Bernthal, Director of Entrepreneurship Initiatives of the Silicon Flatirons Center, and Cathy Kunst, Executive Director of the Bard Center, convened a roundtable-style meeting at the Bard Center to discuss higher education and entrepreneurship in Colorado (the “Roundtable”). A draft report authored by Micah Schwalb, entitled *Higher Education & Entrepreneurship Education in Colorado* (the “Report”), provided the intellectual framework for the Roundtable’s discussion. This memorandum (“Memo”) summarizes the high level comments and recommendations of the Roundtable participants and invites further comment before release of the Memo and Report.

**Roundtable participants’ feedback on the proposals discussed in this Memo as well as the Report are welcome (and encouraged). Please send feedback by end of day Friday, July 3, 2009.**

This feedback will inform the materials submitted to the Governor Ritter’s Innovation Council. A cover note to the Innovation Council will make clear that neither the Report nor the Roundtable Memo represent the unanimous view of the Roundtable’s participants. Rather, it will specify that the Roundtable provided a helpful sounding board which informed the Memo and Report by eliciting thoughts, suggestions, and feedback of entrepreneurial education leaders and members of the business community.

A list of participants is attached as **Exhibit A**. Discussion focused on three areas: (i) an accounting of notable entrepreneurial initiatives at Colorado colleges and universities, as well as opportunities for collaboration; (ii) the role of Colorado’s colleges and universities in facilitating entrepreneurial networks; and (iii) university efforts which effectively spur economic development, including existing entrepreneurial education efforts to serve and support older entrepreneurs who are starting a business in Colorado.

The Roundtable identified the need to (1) raise awareness concerning the already extensive range of existing entrepreneurship initiatives at colleges and universities; (2) facilitate sensible collaboration (e.g., grant writing) and information sharing among Colorado’s higher educational institutions; and (3) establish a pan-university entrepreneurial forum or network which can facilitate #1 and #2, as well as consider and weigh in on policy issues which affect entrepreneurial education. This Memo will discuss these areas before proposing several initiatives.

## II. MAPPING EXISTING INITIATIVES

The report features a thorough survey of major existing entrepreneurship initiatives at higher educational institutions across Colorado. The Roundtable augmented this survey with additional information. The final Report will be updated in view of the additional information elicited through the Roundtable.

To date, an adequate compilation of university-based entrepreneurial initiatives is absent. Indeed, a common response from Roundtable participants from outside academia was “Wow . . . I had no idea this is going on.” As discussed below, such a response underscores the importance of better messaging concerning existing entrepreneurial initiatives in higher education.

## III. OPPORTUNITIES FOR IMPROVEMENT

### I. *Raise Awareness of Entrepreneurship Initiatives*

Several discussants observed that they were unaware of the breadth of entrepreneurship education activity in Colorado. Perhaps more disconcerting was the suggestion that some entrepreneurial communities feel alienated from education centers. This suggests a pressing need to raise awareness of existing entrepreneurship initiatives at two levels:

- **Entrepreneurial Community** – awareness efforts should highlight the existing initiatives, state the focus and strengths of those initiatives, and provide a point of contact.
- **State of Colorado** – awareness efforts should provide the Office of Economic Development with a resource of initiatives and success stories to better market Colorado.

### II. *Facilitate Collaboration and Information Sharing Among Educational Institutions*

The overview of existing entrepreneurship initiatives highlighted several areas of overlap among different campuses and organizations. This overlap raises possibilities for sensible collaboration such as, for example, pursuing grant opportunities. It additionally could facilitate information sharing concerning common endeavors repeated at different campuses, such as meet-ups (and creation of entrepreneurial networks), business plan competitions, university-centered venture funds, and incubator-type activities. In particular, there is an opportunity to facilitate collaboration among two groups:

- **University-University:** Pan university collaboration spanning campuses which identifies common or overlapping programs could obviate the need to “re-invent” existing programs. It would also promote sharing of ideas concerning successful initiatives and courses which could be replicated elsewhere. For example, to the extent that an innovative cross-disciplinary class works at one university, it may be a class that another university should consider. Another possible benefit could be cooperative fundraising efforts, such as grant applications to entrepreneurship-oriented foundations such as Kauffman.
- **University-Community arrangements:** Some discussants mentioned that they were too resource constrained to take on additional, community-focused initiatives. It was observed that community experts may be willing to teach crash courses or serve as mentors to local entrepreneurs. Such community engagement might help universities supplement existing offerings to further meet the needs of entrepreneurs. For example, certain entrepreneurship education offerings emphasize “what to do” (*e.g.*, a more descriptive and academic approach, sometimes associated with undergraduate education) while older entrepreneurs are concerned with “how to do” implementation (*e.g.*, a hand-on, applied approach involving how to resolve specific problems). Community collaboration in crafting applied offerings may be a welcome addition to supplement existing offerings.

### III. *Develop a Pan-Campus Network Focused Upon Entrepreneurial Education Issues*

There does not yet exist a pan-campus body or entity in Colorado which considers and weighs in on issues which affect entrepreneurial education. A unified voice could be particularly helpful in identifying issues which require high-level university administrative and/or state government attention. For example, the Roundtable discussion highlighted the need to reward faculty entrepreneurial engagement so that such activity becomes part of a faculty member's incentive system. Solutions range from providing "service" credit for faculty who assist the entrepreneurial community, to creation of a "professional practice" category of credit, to explicit inclusion of such activity as favorable in tenure review. As yet there is no consensus in Colorado about the best way to accomplish this and, indeed, such discussions are often Sisyphean when conducted on a case-by-case basis. By establishing a forum to analyze and advocate for policy initiatives, entrepreneurship educators can best promote smart policy at the university and state levels.

## IV. **RECOMMENDATIONS: SPECIFIC INITIATIVES**

### I. *Resource Heavy: Entrepreneurship Education Clearinghouse*

An obvious action to assist with both raising awareness and facilitating collaboration is to establish a clearinghouse of entrepreneurship education initiatives in Colorado. At a minimum, this clearinghouse would provide a point of entry for those external to the university in identifying relevant initiatives and resources. Additionally, a more ambitious role for the clearinghouse would be to help connect individuals and companies outside the university to relevant research labs, professors, and student talent. In either form, the clearinghouse would serve the local community, the state of Colorado, and the university educators. However, this may not be realistic without the resources to build a quality product, maintain the clearinghouse, and properly promote the clearinghouse.

### II. *Resource Lite: Grassroots Awareness Drive*

If resources are not available to build, maintain, and promote the clearinghouse described above, a grassroots effort may capture the low-hanging fruit. By providing information on local entrepreneurship initiatives annually at the ubiquitous meet-ups, educators can raise awareness within an interested and engaged community. One a state level, the Office of Economic Development would likely welcome an easy-to-use summary of existing initiatives with points-of-contact for further information. Finally, meeting with focus groups of 5-10 CEO's could solicit feedback on existing initiatives and advice for future efforts. The challenge with this course of action is identifying volunteers to take these steps.

### III. *Facilitate Collaboration and Establish a Policy Forum*

To facilitate collaboration and establish a forum for policy discussion, the roundtable should commit to meet, in-person, twice a year with a third phone-in meeting. Meetings will focus on sustaining awareness of existing initiatives, building awareness of new initiatives, and identifying areas where a policy analysis or advocacy is needed. In addition, an email reflector or social network could facilitate discussion between meetings.

## CONCLUSION

There is considerable breadth and depth to the entrepreneurship education initiatives in Colorado; however, there are areas for improvement. The roundtable discussion on June 24, 2009 identified several of these areas. This memorandum proposes several initiatives to meet those needs. We would appreciate your feedback on this memorandum and the "Higher Entrepreneurship & Entrepreneurship in Colorado" report. Please submit your feedback to Brad Bernthal (brad.bernthal@colorado.edu) by Friday, July 3, 2009 for inform the presentation to Governor Ritter's Innovation Council.

**Exhibit A:**

**LIST OF PARTICIPANTS**

Dave Allen	University of Colorado, TTO
Brad Bernthal	CU Law/Silicon Flatirons Center
Matt Emmi	One Button
Gregory Graff	CSU, Economics
Paul Jerde	CU/Deming Center
Randy Kenworthy	Bard Center AC member
Therese Kerfoot	CU Law Student
Cathy Kunst	CU/Bard Center
Michael Larson	CU at Colorado Springs
Steve Lawrence	CU/Deming Center
Tiffani Lennon	DU
Tom Lookabaugh	CU/Silicon Flatirons Center
Catharine Merigold	Vista Ventures
Rob Novick	Envision
Nina Polok	CU CS
Jim Schoedinger	Bard Center AC member
Micah Schwalb	Viaero Wireless
Paul Shoning	Silicon Flatirons Center
Marc Spritzer	CoBiz Financial
Mark Wdowik	Colorado State University
Cliff Young	CU Denver