

# Boise, Idaho:

## An Overview of the High-Technology Economy in the Treasure Valley

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### Executive Summary

Boise, Idaho, is part of a growing community of so-called emerging high-technology regions. Even though Boise's high-tech economy is small when compared to places like Silicon Valley or Seattle, the technology community in the Treasure Valley is highly specialized and very entrepreneurial. The region is home to leading high-technology employers such as Hewlett-Packard and Micron Technology. These firms contributed to the creation of a skilled labor pool and the formation of many dynamic and entrepreneurial startups. This white paper presents the result of an online survey of 135 high-tech firms in Boise. The survey was conducted by the author in 2007. We highlight characteristics of the region's high-tech economy and interpret the survey results. This paper and a visual representation of the genealogy of Boise's high-tech community is available online at: [http://www.nvc.vt.edu/uap/research/knowledge\\_regions.html](http://www.nvc.vt.edu/uap/research/knowledge_regions.html).

### High-Tech Economy

Compared to other high-tech regions, Boise's high-technology industry is rather small: The region's 34,081 high-tech workers are employed by 1,335 firms, of which 77 percent employ less than 9 people and a mere 3.4 percent employ more than 100. The industry is highly specialized in sectors such as semiconductor manufacturing, computer and electronic products, software publishing, and engineering services.

### Evolution of Boise's High-Tech Community

Boise's roots in high-technology go back to the early 1970s when Hewlett-Packard (HP) decided to establish a branch operation to manufacture printers and magnetic tape drives. HP's move to Boise in 1973 was followed by the firm's entry into the laser printer market in the early 1980s. As a result, HP's Boise operation focuses on all aspects of the laser printer. In 1978, four Idaho natives founded Micron Technology, a leading semiconductor manufacturing company. Boise's high-tech community grew despite the lack of a world-class research university. Instead, HP and Micron functioned as so-called "surrogate universities" attracting talent, fostering entrepreneurship and creating innovations. The firms, however, differed in important ways as outlined in this paper. Over time, the region was also able to develop an entrepreneurial milieu. Despite the lack of attention from state and local policymakers, the Boise region was able to develop a vibrant knowledge-based economy.

### Implication for Public Policy

Idaho's state and local policymakers have to understand and recognize the importance of the knowledge economy. They need to support entrepreneurship, industry-university connections, workforce and skill development, talent creation, and the region's quality of life. Knowledge-based industries are critical for future growth for any region, and Boise needs to recognize that it already has the right prerequisites to succeed in a knowledge economy. To take the region to the next level, policymakers need to make strategic investments in their universities, connect to and leverage industry R&D, and they need to develop, attract, and retain talent.

## High-Tech in Boise, Idaho

Boise is part of Idaho's Treasure Valley, which is located in the southwest corner of the state. The region has experienced tremendous population growth over the past decades. From 1970 to today, the Boise metropolitan area has grown fivefold from 115,000 to about 532,000 residents.<sup>1</sup> One of the reasons of this tremendous population growth – besides in-migration from neighboring states – has been the emergence of a vibrant high-technology economy.

In 2005, the U.S. Census counted 1,335 high-technology firms in the Boise metropolitan region.<sup>2</sup> As a group, these firms employ more than 34,081 people. Boise's high-tech economy is highly specialized in sectors such as semiconductor manufacturing, computer and electronic products, software publishing, and engineering services. This kind of specialization is reflected in the high location quotients, a measure of relative concentration of an industry, of level 1 industries. However, we have to note that level 1 high-tech sectors are becoming less concentrated in the region, which may be the result of recession-related downturns in the semiconductor sector.

Boise's high-tech economy has experienced healthy growth during the last couple of years. High-tech employment grew by 20 percent from 1999 to 2005. Level 2 and 3 high-tech sectors have experienced positive growth rates in the years following the 2001 burst of the dot.com bubble. Compared to other similarly sized and positioned regions, Boise stands out for its entrepreneurial dynamics (see Table 2). The region has a high rate of entrepreneurial churning (as illustrated by the firm birth-to-death ratio) and it has a high percentage of people considered as self-employment (19 percent).

**Table 1: High-Tech Employment and Specialization in the Boise-Nampa MSA, 1999 to 2005**

Industry					Change		
	1999	2001	2003	2005	1999-2001	2001-2003	2003-2005
<b>Level 1</b>							
High-Tech Employment	16,761	10,274	19,215	18,969	-39%	87%	-1%
Location Quotient, Level 1	1.88	1.04	1.89	1.75	-44%	81%	-8%
<b>Level 2</b>							
High-Tech Employment	3,272	4,653	4,873	4,922	42%	5%	1%
Location Quotient, Level 2	0.92	1.18	0.95	0.88	29%	-20%	-7%
<b>Level 3</b>							
High-Tech Employment	7,212	8,373	9,411	10,190	16%	12%	8%
Location Quotient, Level 3	0.99	1.07	0.96	1.03	8%	-10%	7%
<b>All High-Tech Industries</b>							
Total Empl. in High-Tech	27,245	23,300	33,499	34,081	-14%	44%	2%
Location Quotient, all	1.38	1.08	1.34	1.29	-22%	24%	-3%
Number of High-Tech Firms	744	895	1,200	1,335	20%	34%	11%
<b>Total Regional Employment</b>	187,887	207,971	203,129	219,443	11%	-2%	8%

Source: County Business Patterns, 1998 to 2005

<sup>1</sup> Blanchard, C. (2005). This Urban Idaho. *Idaho Issues Online*. Retrieved November 4, 2007, from [http://www.boisestate.edu/history/issuesonline/spring2006\\_issues/5f\\_numbers\\_06spr.html#](http://www.boisestate.edu/history/issuesonline/spring2006_issues/5f_numbers_06spr.html#)

<sup>2</sup> We employ Hecker's definition of high-technology. See Hecker, D. (2005). High-technology employment: A NAICS-based update. *Monthly Labor Review* (July).

Even though the Boise economy is entrepreneurial, the region ranks below average among similar second tier high-tech regions on measures of industry, talent, and innovation. Compared to the metropolitan areas of Provo, Salt Lake City, Colorado Springs, Denver, and Portland, Boise has the lowest percentage of its population with a Bachelors degree (12.3 percent). The percent of people in creative or bohemian (i.e. artistic) occupations is also lower than in these other regions. In addition, Boise's share of R&D employment is the lowest among these regions. Measures of R&D and innovation are well below the average as well.

**Table 2: Comparing Boise to Other Regions in the West**

Indicator - Industry - Talent - Innovation - Entrepreneurship	Boise City- Nampa, ID	Provo- Orem, UT	Colorado Springs, CO	Denver- Aurora, CO	Portland- Vancouver - Beaverton, OR-WA	Salt Lake City, UT	AVERAGE for Second- Tier High- Tech Regions
Population (2000)	545,147	461,000	586,732	2,361,774	2,096,585	1,046,712	na
Employment in High-Tech (2005)	34,081	17,625	31,466	159,972	127,236	65,817	63,467
Employment: % Change (1998-2005)	20%	32%	19%	46%	32%	30%	29%
High-Tech Establishments (2005)	1,335	982	1,792	9,346	5,614	3,224	2,523
GDP from High-Tech (2005)	34%	38%	35%	41%	36%	40%	38%
Dispersion (Personal Income as % of GDP)	80%	85%	92%	76%	78%	66%	81%
Industry Index*	87	106	96	113	98	93	100
% Creative Employment (2000)	26.40%	28.70%	30.00%	32.70%	28.80%	27.40%	27.80%
% Bohemian Employment (2000)	1.00%	1.60%	1.30%	1.20%	1.40%	1.30%	1.20%
% with Bachelors Degree (2000)	12.30%	14.90%	20.90%	23.20%	16.00%	20.30%	16.00%
Talent Index*	88	101	116	127	103	109	100
Share of R&D Employment (2005)	6%	8%	16%	33%	76%	61%	27%
Cumulative R&D Funding (1998-2005)	506	198	1,864	3,031	2,087	1,930	3,401
Number of Patents (1990-1999)	3,984	745	1,535	7,847	15,874	2,452	4,755
Innovation Index*	98	30	59	43	113	56	100
Firm Births/Deaths (1998-2005)	126%	131%	117%	112%	110%	117%	110%
% Self-Employed (2000)	19%	15%	16%	18%	15%	16%	13%
Business Density (# Firms/1000 Inhabitants)	3.04	2.07	2.77	3.11	2.91	2.95	2.6
Small Business Innovation Research Grants (1998-2004)	5	26	292	587	333	205	211
Entrepreneurship Index*	117	92	107	115	108	111	100

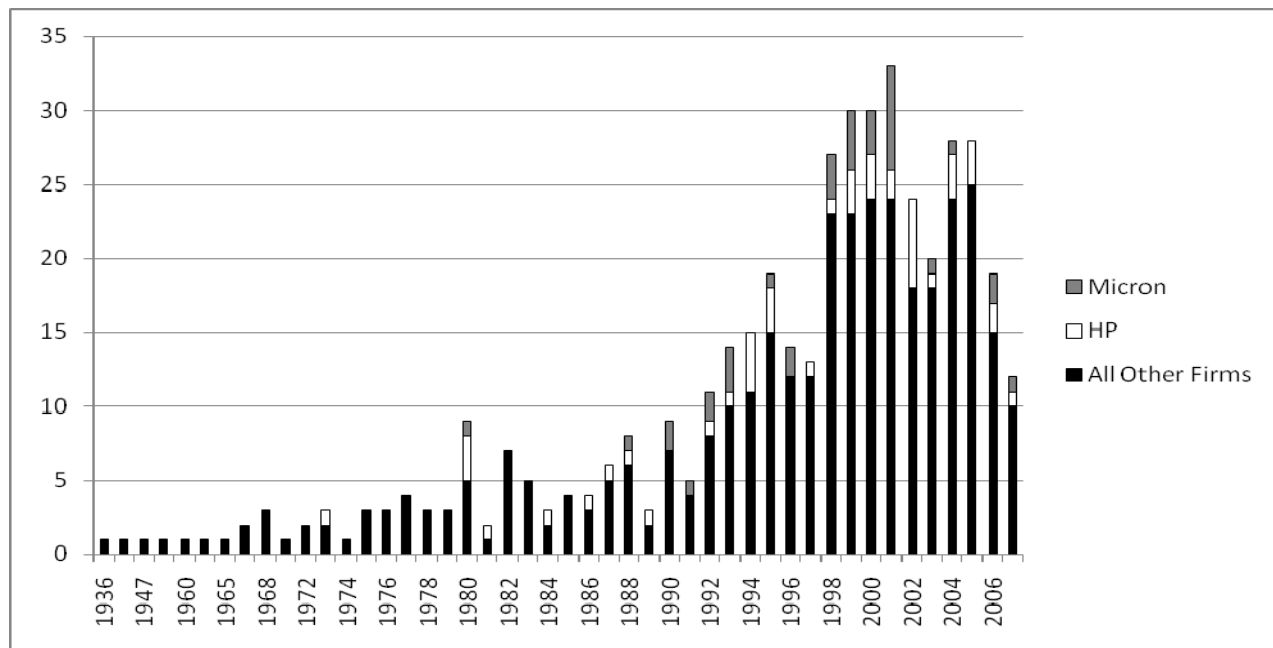
Source: Author's research. All measures are for the metropolitan areas.

Note: \*We applied a specific weighing scheme for each index. The entrepreneurship index does not include SBIR grants as a component. This is primarily due to the high volatility of that variable. For a methodology, please see Mayer & Bieri (Forthcoming) *Bootstrapping High-Tech: Evidence from Emerging Second Tier High-Tech Regions*. The Brookings Institution, Washington D.C.

## Survey Results

We conducted an online survey of high-technology firms in Boise during summer and fall 2007. The survey was sent out to individual firms and to groups following a snowball sampling method. We received a total of 162 responses of which 135 were valid. Problematic was that many survey respondents did not complete the entire questionnaire and often skipped questions. As a result only 92 respondents completed the questionnaire and actual numbers of answers valid for analysis vary.<sup>3</sup> The questionnaire included inquiries into the genealogy of entrepreneurial firms, as well as questions about founders' backgrounds and entrepreneurial motivations, university-industry relationships, global connections of entrepreneurial firms, and the competitive advantages and disadvantages of the Boise region as a business location.

Independent of the survey, we also created a listing of 357 firms and included data on their founding years. Figure 1 illustrates the entrepreneurial dynamics in the Boise metropolitan region. The figure illustrates the share of firms that were started by former Micron or HP employees as well as those that were started by these anchor firms as wholly owned subsidiaries. The region experienced two peaks in entrepreneurial startup activities: During the mid 1990s and in the years around 2000 and 2001. The formation of startups declined after the burst of the dot.com bubble in 2001, but it has picked up again in later years. It should be noted that it is likely that we undercount startups for 2006 and 2007.



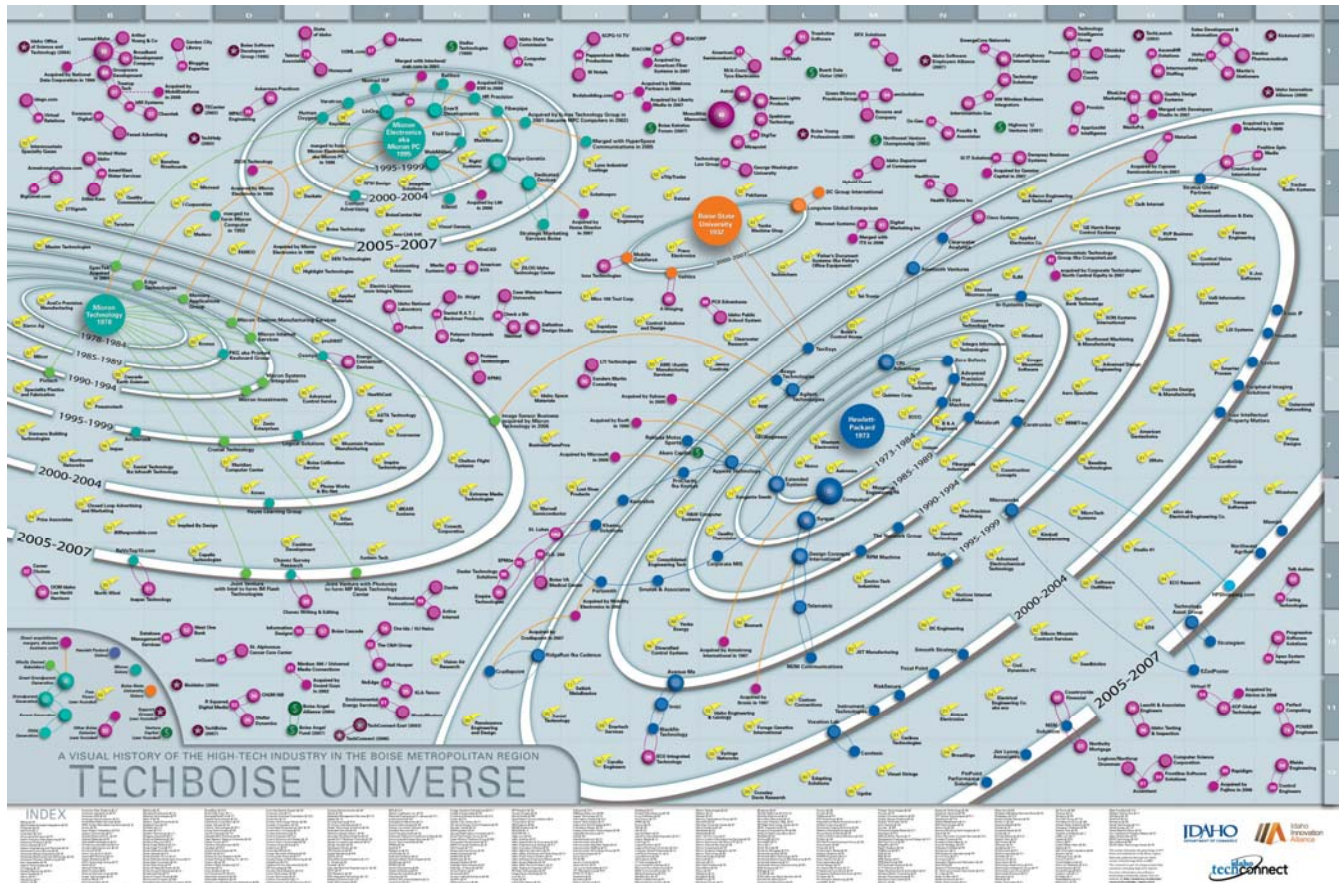
**Figure 1: Startups in Boise by Year, 1936 to 2007**

Source: Author's Research

<sup>3</sup> E-mail addresses were collected for about 215 firms and the survey was sent to them via e-mail. The survey was also sent out by the following groups: Kickstand and the Idaho Office of Science and Technology. Several individuals forwarded the survey e-mail to other individuals and groups. The online survey allowed individuals and companies to fill out the survey without access restrictions. This allowed for the possibility of invalid responses. A total of 26 invalid responses were received. They included: 5 responses that were either test entries or jokes, 12 multiple entries (several individuals from one firm filled out the survey), 1 responses from an individual for whom the company could not be verified, 5 firms that do not belong in the industry categories we were interested in (i.e. catering service, financial services, etc.), 1 firm that does not exist anymore, and 2 firms located outside of the Boise-Nampa Metropolitan Statistical Area. Of the 135 valid responses, 92 respondents completed the survey.

## Evolution of Boise's High-Tech Community

Boise's roots in high-technology go back to the early 1970s when Hewlett-Packard (HP) decided to establish a branch operation to manufacture printers and magnetic tape drives. HP's move to Boise in 1973 was followed by the firm's entry into the laser printer market in the early 1980s. As a result, HP's Boise operation focuses on all aspects of the laser printer. In 1978, four Idaho natives founded Micron Technology, a leading semiconductor manufacturing company. Boise's high-tech community grew despite the lack of a world-class research university. Instead, HP and Micron functioned as so-called "surrogate universities" attracting talent, fostering entrepreneurship and creating innovations. The firms, however, differed in important ways as outlined in this paper. Over time, the region was also able to develop an entrepreneurial milieu. For example, entrepreneurs and private sector representatives have formed networks such as Kickstand and the Boise Software Developers Group. In 2008, TechConnect initiated the formation of the Idaho Innovation Alliance, a private sector led group interested in supporting the knowledge-based economy. Public policy efforts to support the emerging entrepreneurial economy have significantly lagged behind those of other regions and states. Despite the lack of focus from policymakers, the Boise region was able to grow a vital and entrepreneurial innovation economy as illustrated in Figure 2. The TechBoise Universe illustrates the genealogy of high-tech firms and how they relate to HP (blue solar systems in the poster) and Micron Technology (green solar systems).



**Figure 2: The TechBoise Universe Visualizes the Genealogy of Entrepreneurship**

Source: Author's Research; Copyright: Heike Mayer. The picture is available for download at:

[http://www.nvc.vt.edu/uap/docs/HeikePublications/Boise\\_poster\\_jpgs/TechBoise-2600.jpg](http://www.nvc.vt.edu/uap/docs/HeikePublications/Boise_poster_jpgs/TechBoise-2600.jpg)

## Characteristics of Survey Respondents

Boise's high-technology economy is dominated by small firms. According to County Business Patterns, more than 77 percent of the firms employ less than 10 people. Even though the response rate to our survey was low when compared to the overall population of firms, the characteristics of the respondents seem to be similar to Boise's high-tech firms in general. 92 respondents indicated the size of their firms with 40 percent employing 1 to 4 people and 25 percent employing 5 to 9 people. Unfortunately, the survey did not capture any of the larger firms that employ more than 250 people. Neither Micron Technology nor Hewlett-Packard answered the survey. This represents a serious shortcoming and the results presented here need to be interpreted with this in mind. Consequently, the survey responses relate to the smaller entrepreneurial firms and not to large firms like HP or Micron.

**Table 3: Employment Levels at Boise's Startup Firms: Survey Response (N=92)**

Employment Category	Survey Respondents, 2007 (Completed Questionnaires)		County Business Patterns, 2005	
	Number	Percent	Number	Percent
1 to 4	37	40.21%	837	62.7%
5 to 9	23	25.00%	192	14.4%
10 to 19	8	8.69%	126	9.4%
20 to 49	14	15.21%	100	7.5%
50 to 99	5	5.43%	35	2.6%
100 to 249	5	5.43%	27	2.0%
250 to 499	0	0%	10	0.7%
500 to 999	0	0%	4	0.3%
1,000 or more	0	0%	4	0.3%
Total	92	100%	1,335	100%

Source: Boise Survey, County Business Patterns

## Bootstrapping High-Tech Firms

As a second tier emerging high-tech region, Boise has not been able to attract large amounts of venture capital. The lack of venture capital, however, is a shortcoming that is typical for emerging high-tech regions. Most venture capital is invested in the so-called pioneering high-tech regions such as Silicon Valley or Boston. Silicon Valley, for example, received 35 percent of the \$7.1 billion invested in companies during the third quarter in 2007. The New England region claimed a 14 percent share of the venture capital dollars during this period.<sup>4</sup> As a result, almost 50 percent of venture capital investments are made in only two regions in the U.S.

There is also a large debate in the literature whether venture capital investments spur entrepreneurial development or whether promising deals (i.e. technologies, business ideas, etc.) attract venture capital investments. This so-called "chicken and egg" problem might have a unique local dimension. In Portland, for example, venture capital investments followed the availability of deals and ideas.<sup>5</sup> This may also be the case in Boise and with the maturing of a local investment

<sup>4</sup> PricewaterhouseCoopers & National Venture Capital Association (2007). MoneyTree Report. Retrieved January 3, 2008, from [https://www.pwcmoneytree.com/MTPublic/ns/moneytree/filesource/exhibits/Q307\\_Money%20Tree\\_Report\\_Final.pdf](https://www.pwcmoneytree.com/MTPublic/ns/moneytree/filesource/exhibits/Q307_Money%20Tree_Report_Final.pdf)

<sup>5</sup> Mayer, H. (2005). Taking root in the Silicon Forest: The role of high technology firms as surrogate universities in Portland, Oregon. *Journal of the American Planning Association*, 71(3), 318-333.

community the region may see more deals in the future. Boise's entrepreneurs have been creative in bootstrapping their companies and there may be a capital gap especially as it relates to seed funding.

Starting in the late 1990s, a small venture and angel investor community began to form in the Boise metropolitan region. Akers Capital, one of the first locally based venture capital firms, was founded in 1999. Highway 12, a venture capital firm, opened its office in downtown Boise in 2001. The Boise Angel Alliance formed in 2004 and some of its members started the \$800,000 Boise Angel Fund in 2007. In 2007, Boise investors formed a local chapter of the Keiretsu Forum. Several Seattle-based venture capital firms have recognized the potential of the Boise region and keep tabs on the high-tech community: Frazier Technology Ventures and Buerk Dale Victor have established offices in the Treasure Valley. The emergence of a vibrant investment community indicates that Boise's entrepreneurial and small business community may have more local capital available than in the past.

Even though the region matured in terms of the availability of risk capital, most firms do not take advantage of it. The survey results reveal that the majority of entrepreneurs (82 percent) rely on personal finances to fund their businesses. 20 percent also use bank loans and a similar percentage use funding from friends and family members. About 14 companies received angel investments. This illustrates that the creation of an angel community in Boise has had an impact on the formation of firms. Of the 92 firms that answered this question, only six firms received venture capital investments. Overall, we observe that startup companies bootstrap their ventures with funds out of their own pocket or that of friends and families, often the most important source of funding.

**Table 4: Firm Financing**

"How did you finance your company?" (N=92)

Type of Financing	Number	%
Personal Finances	76	82.61%
Bank Loan	19	20.65%
Friends & Family	19	20.65%
Angel Investments	14	15.22%
Other	10	10.87%
Venture Capital	6	6.52%

Note: Number of total respondents given in brackets. Please note that respondents were able to check all that apply, so percentages do not add up to 100%. Source: Boise Survey

### Where Do Entrepreneurs Come From?

Boise's high-tech economy is primarily fueled by entrepreneurs who leave their prior employers (other firms) to start a new company. The survey results dispel two commonly held myths about entrepreneurs: Entrepreneurs originate from universities and universities can be engines of regional economic growth because they create startup companies; and that startups are formed by one person, the heroic founder. Both statements are not true for Boise. The majority of the founders (62 percent) involved with the 135 surveyed startup companies noted that they worked at other firms immediately prior to founding the startups. Only 38 percent of the firms were founded by one individual. In contrast, 61 percent involved founding teams. 53 percent of the founders engaged in these startups have had prior startup experience, indicating that Boise is home to several serial entrepreneurs. The startup companies surveyed here, however, have not become wellsprings of

entrepreneurial activities themselves. Only 9 percent of the 135 firms reported that former employees of these firms have left and started new companies.

**Table 5: Founding Teams, Serial Entrepreneurs and Subsequent Startups**

Founding Teams (N=135)	Number	%
1 Founder	52	38.52%
2 Founders	47	34.81%
More than 2 Founders	36	26.67%
Serial Entrepreneurs (N=100)	53	53%
New Business Startups by Former Employees (N=97)	9	9.27%

Source: Boise Survey

Hewlett-Packard and to a lesser extent Micron Technology served as incubators for entrepreneurship. 26 founders are former Hewlett-Packard employees while only 9 founders trace their roots to Micron Technology. There are various reasons why HP and Micron differ in terms of their function as entrepreneurial incubators. The degree of entrepreneurial spawning from companies like HP and Micron depends on the business model, innovation culture, and the nature and type of product of the incubating firm. For example, HP's technologies and products – printers – are distinguished by a high degree of customization and innovative features. In contrast, for Micron Technology's products – the semiconductor memory chips – price is the distinguishing feature. In addition, the two firms have very different customers: Micron produces for an intermediary market while HP produces for the end consumer. These different orientations influence the nature of marketing, the type of employees hired, etc. Additionally, Micron Technology represents a vertically integrated firm where research and development efforts are intimately tied to mass production manufacturing. Whereas HP started to pioneer strategic business alliances with other firms such as Canon in the production of the laser printer in the early 1980s, Micron is fairly self-sufficient. HP's decentralized business culture and its famous "HP Way" created a culture of learning. Nascent entrepreneurs gained critical skills not only related to technology but also to novel management practices and business relationships. In contrast, interviewees often noted the secretive and frugal corporate culture at Micron Technology. These corporate differences may have facilitated HP's larger contribution to Boise's entrepreneurial community compared to Micron's limited influence (for a comparison of the two firms, see also Table 7).

**Table 6: Where do Entrepreneurs Come From? Parent Type**

Prior Employer of Founders	Founders	%
Other Firms	112	62.57%
Hewlett-Packard	26	14.53%
Government, Public Agency, Hospital	15	8.38%
Micron Technology	9	5.03%
Self-Employed	9	5.03%
University	8	4.47%
Total	179	100%

Source: Boise Survey

The Boise region clearly benefitted from the presence of Hewlett-Packard and to a limited degree from Micron Technology. Table 7 illustrates the connection between firm culture and entrepreneurial development. The growth of the high-tech economy in the region was propelled by the founding of new firms. The region has been known for its entrepreneurial spirit. Examples like



Albertsons, J.R. Simplot, Morrison Knudsen (now Washington Group International) and other firms that were founded by Idaho natives illustrate Boise's prominent culture of risk taking and entrepreneurship. Policymakers need to recognize that economic development and progress depends on attracting and retaining entrepreneurial individuals. An often overlooked asset is Boise's ability to attract entrepreneurs interested in moving away from high-cost urban areas such as San Francisco and Seattle. They value the region's quality of life and ease of doing business. Entrepreneurs are clearly the economic engine of the region.

**Table 7: Firm Building and Entrepreneurship: Hewlett-Packard versus Micron Technology**

Firm Building	Entrepreneurial Firm Formation	Hewlett-Packard	Micron Technology
Organizational evolution of firm	Corporate changes may facilitate entrepreneurship.	Transformed from manufacturing to focus on R&D + marketing	Limited divisionalization Expansion outside of region (i.e. Lehi, China)
Product Type	Startups are more likely to occur when market is based on product attributes rather than price.	LaserJet Consumer products End consumer	Chips Commodity Price sensitive
Nature of Production	Entrepreneurship more likely when firm concentrates on conception rather than execution/production phase.	Breaking with the "not invented here" syndrome: HP-Canon relationship Hardware & Software	"Just making chips" Except for MPC
Linkages	Opportunities for backward and forward linkages enhance entrepreneurship.	Disintegration facilitated contracting opportunities.	Did not induce industry clustering
Market Connections	Startups may exploit market opportunities. Entrepreneurs may take advantage of parent's market connections.	HP attracted talent to the region. Employees had connections to the outside. Market = End consumer	Intermediary supplier Micron PC had more startups because of different nature of product (PC vs. chips).
Corporate Policies	Corporate policies shape startup activities.	"HP Way" Welcome Mat	"Secretive" "Frugal"
Labor	Technical and managerial labor is critical for entrepreneurship.	Engineer Manager	Technical

Source: Author's Research

### Entrepreneurial Backgrounds

The majority of the founders in this study have a strong background in research and development. Only a few indicated that their background is in sales and marketing. Open-ended answers in the "Other" category indicate that many of the founders have a technical or managerial background. This survey finding is supported by the interviews we conducted for this study. The majority of the entrepreneurs interviewed indicated that they held positions in R&D before they started their ventures. Those who worked for Hewlett-Packard experienced similar career paths: They generally

started as engineers (electrical, software, mechanical) and they progressed to managing groups within the company later on (becoming the so called engineer manager). Many firms in the Hewlett-Packard family specialize in the combination of hardware and software and their founders' skills are primarily in embedded software and firmware development. This indicates a unique area of specialization and competency of the Boise economy.

**Table 8: Prior Positions of Founders (N=181)**

“What was founder’s position at his/her prior employer?”

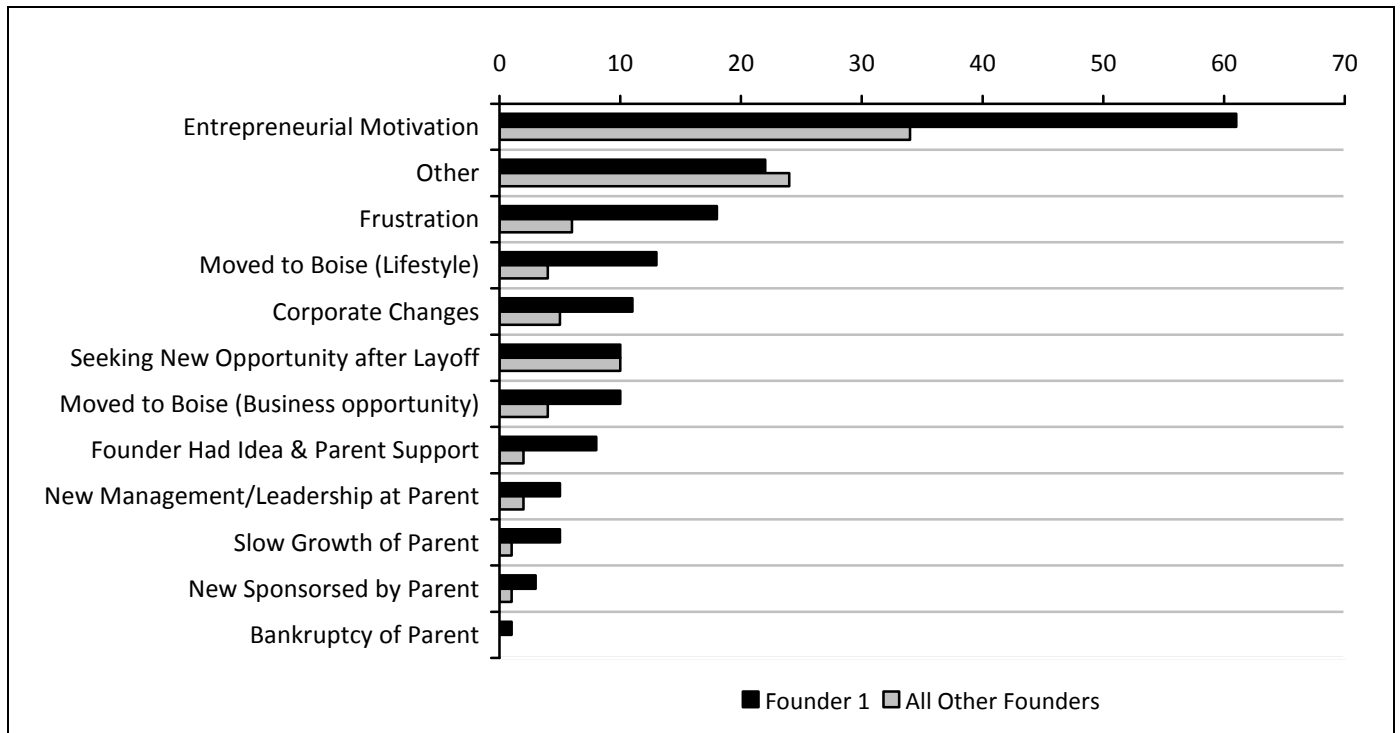
Position	Founder 1	Other Founders
Other	54.81% (57)	55.84% (43)
R&D	29.81% (31)	22.08 (17)
Production	2.88% (3)	5.19% (4)
Marketing	6.73% (7)	11.69% (9)
Sales	5.77% (6)	5.19% (4)

Source: Boise Survey

### Entrepreneurial Motivations

Asked about what prompted the founders to leave their prior employer, most indicated that it was the motivation to become entrepreneurs and to expect financial rewards and be your own boss (see Figure 3). However, it is interesting to see that frustration with the previous employer as well as corporate changes rank high as well. Boise’s quality of life also attracted entrepreneurs and the motivation to move to the area for lifestyle reasons was given as another prominent reason why entrepreneurs left their previous employer.

Both Hewlett-Packard and Micron Technology significantly changed since they started in Boise in the 1970s. Several of the interviewees noted that HP changed its management and innovation culture. These corporate changes may have influenced employees and convinced them to become entrepreneurs. This illustrates that not only pull factors such as entrepreneurial motivation but also push factors such as frustration with the employer may play an important role in the entrepreneurial process.



**Figure 3: Entrepreneurial Motivations**

“What prompted the founder to leave the previous employer to start this firm? (Check all that apply)”

Source: Boise Survey

Note: Founder 1 refers to the information given for the first founder.

**Linkages with Parent Firms**

We also assessed the nature of relationships between startup companies and their parent firms (the former employer(s) of the founders). Asked about the ways in which firms are or have been involved with their parent firms, the majority (71 percent) responded that they did not have any relationships with their parents. 11 percent indicated that their parent firms are customers. A very small share (3 and 2 percent) indicated that their parent firms were involved with their startup as investors, sponsors of technology or suppliers.

**Table 9: Linkages with Parent Firms**

“In what ways were or are the parent firms involved with your firm?” (N=100)

Type of Relationship	Number	%
Not at all	71	71%
As a customer	11	11%
Other	10	10%
As a financier/investor	3	3%
As a sponsor of technologies or products	3	3%
As a supplier	2	2%

Source: Boise Survey

Does the presence of Micron Technology and Hewlett-Packard facilitate business relationships between these firms and startup companies? While most firms indicated that they do not engage with Micron or HP (75.5 percent), a small subset do. We can also see differences between the firms and how they interact with the larger group of firms in the Boise high-tech economy. HP seems to have developed a larger set of backward (supplier) and forward (customer) linkages with locally

based firms than Micron Technology. R&D partnerships between these firms seem to not play a role. The possibilities of working with Hewlett-Packard as a customer were also echoed in the interviews. Overall, however, Micron and HP have not contributed to the development of a cluster-based regional economy.<sup>6</sup>

**Table 10: Business Relationships with Boise's Anchor Firms**

"In what ways does your company interact with the following businesses?" (N= 98)

Anchor Firms	Customer	Supplier	Competitor	R&D Partner	Not at all
Micron Technology	13.3%	9.2%	0%	2.0%	75.5%
Hewlett-Packard	15.3%	16.3%	1.0%	1.0%	68.4%

Source: Boise Survey

Entrepreneurial startups contribute to the diversification of the regional economy. When asked whether the product, technology or services are similar or different to their parent firms', the majority of the respondents indicated that they operate in new markets. Therefore, fostering entrepreneurship in a region contributes to economic diversification. A diverse economy, in turn, is more resilient than a specialized economy.

**Table 11: Market Similarity with Parent Firm**

"Is your company's product/technology/service in a similar or a new market compared to your parent firms?" (N=99)

Type of Relationship	Number	%
New Market	68	68.68%
Variant of Parent's Product/Technology/Service	27	27.27%
Same as Parent	4	4.04%

Source: Boise Survey

Entrepreneurs are influenced by the culture and business practices they experienced at their prior employers. Parent organizations leave large imprints on the startup company regarding business practices such as the technology, management style and innovation models. The majority of the firms in the Hewlett-Packard family tree indicated that their management style, innovation model and hiring practices are similar to their parent firm. In contrast, only two Micron-related startups indicated that their hiring practices and innovation model are similar to their parent firm. This suggests that the "HP Way" diffuses to local startup companies and reinforces our interpretation about the missing influence of Micron on entrepreneurship in the region.<sup>7</sup>

**Table 12: Parent Imprinting**

"Which of the following business practices are most similar to your parent firms?" (N=64)

Business Practice	Number	%
Production/Technology/Services	33	24.44%
Management Style	23	17.03%
Innovation Model	21	15.55%
Hiring Practices	14	10.37%
General Business Model	11	8.14%

Source: Boise Survey

<sup>6</sup> Porter, M. (2000). Location, competition, and economic development: local clusters in a global economy. *Economic Development Quarterly*, 14(1), 15-34.

<sup>7</sup> Packard, D. (1995). *The HP way*. New York: HarperCollins.

## Relationships with Other Regions

A large number of firms in this sample indicated that their firm's manufacturing, R&D, or management was located outside of the Boise metropolitan region. The reason for developing linkages to other regions through the relocation of business activities may be manifold: In terms of manufacturing, companies might want to take advantage of low cost location such as Asia. Relocating R&D to other areas of the country or abroad may not only allow companies to tap into deeper talent pools but also to develop products for different markets (for example, HP opened a facility in Shanghai in order to connect with the emerging East Asian markets). Relocating management may allow companies to access talent in pioneering high-tech regions such as Silicon Valley or Seattle. For Boise, about 25 percent noted that their R&D staff was located somewhere else. Often these linkages were with California (Silicon Valley) or the Pacific Northwest (Portland, Seattle). About 20 percent noted that their manufacturing and management was located somewhere else. For manufacturing, the open-ended answers were split between Asian locations and other U.S. locations. Interestingly, many of the firms that indicated that they have management located in other regions mentioned high-tech regions such as Silicon Valley for the location of their management executives. In the interviews, entrepreneurs noted that it was beneficial to have contacts in these regions because of the market connections they provide. This may be an indication for the ways in which Boise's high-technology entrepreneurs are connected to other high-tech economies.

**Table 13: Functional Linkages to Other Regions**

"Is the firm's manufacturing, R&D, or management located outside of Boise?" (N=94)

Business Function	Yes	No
R&D	25.53% (24)	74.46% (70)
Manufacturing	20.21% (19)	79.78% (75)
Management	20.21% (19)	79.78% (75)

Source: Boise Survey

## Industry-University Relationships

The survey asked high-technology entrepreneurs about the ways in which their firms relate to Boise State University. Almost half of the respondents indicated that they hire graduates from Boise State University. Respondents also value the services offered by the Small Business Development Center (SBDC) and by the TECenter. This indicates that local firms take advantage of Boise's entrepreneurial support system. Other more informal ways of collaboration such as university staff acting as consultants, collaborative research, and company staff teaching classes are listed as well. Licensing or patenting research is the least used way to relate to Boise State University. This may be a reflection of Boise State University's young history and its underdeveloped research capacities.

These findings indicate that regional leaders need to pay attention to higher education institutions such as Boise State University because they could add important value to high-technology firms. Specifically, the university contributes to workforce development and talent creation. Universities are critical to a region's economy because they graduate students who will be hired by local firms. They also provide value added services to entrepreneurs. Other research has shown that industry primarily benefits from informal interactions with universities such as publications/reports, informal

interactions, meetings and conferences, contract research and consulting.<sup>8</sup> Formal mechanisms like licensing and patenting are important, but if they get in the way of informal interactions they may hinder knowledge transfer.

**Table 14: Relationships With Boise State University**

“Which of the following types of relationships has your firm had with Boise State University? (Check all that apply)” (N=90)

Type of Relationship	Responses	%
Hiring Graduates	44	48.89%
Working with TECenter	36	40.00%
Using Services from SBDC	33	36.67%
Other	29	32.22%
University Staff as Consultants	25	27.78%
Collaborative Research Project with BSU	16	17.78%
Company Staff Teaching Classes	14	15.56%
Donations to University	13	14.44%
Using Services Offered by TechHelp	13	14.44%
Training Programs Run by University	12	13.33%
Faculty Working Part-Time With Company	9	10.00%
Faculty on Company's Board	7	7.78%
Being Part of Research Consortia Involving University	3	3.33%
Licensing or Patenting of BSU Research	1	1.11%

Source: Boise Survey

### Boise as a Location for High-Tech Firms: Pros & Cons

On page 18 we report results from questions regarding Boise as a competitive location for high-technology firms. We asked survey respondents about factors that supported or constrained their firms' development. As a second tier high-tech region, Boise experiences significant disadvantages: The region does not attract a large amount of venture capital and local universities have only recently started to build their science and technology capacities. However, entrepreneurs indicated several factors unique to Boise that support their firm's development. When asked about their firm's development, survey respondents rated “attractive local quality of life for staff and management” as very important. Interviewees confirmed this finding. Entrepreneurs mentioned the region's quality of life as an important factor why they stayed or moved to Boise. Several firms and entrepreneurs have moved to Boise because of concerns for livability elsewhere and they saw the region as a desirable place to live and run a business (this is also indicated in Figure 3 when founders were asked about their entrepreneurial motivations). Respondents ranked “informal local access to innovative people, ideas, technologies” second. This finding reveals that local high-tech firms are aware of the region's labor pool as well as the ability to access expertise. It is interesting that research links with various institutions including firms and Idaho-based universities were rated very low. In addition, quality and availability of research staff was not rated very highly either. This may indicate that the region has successfully tapped its innovation capacities without the help of universities and that HP and Micron have served as “surrogate universities”.

<sup>8</sup> Cohen, W., Nelson, R., & Walsh, J. (2002). Links and impacts: The influence of public research on industrial R&D. *Management Science*, 48(1), 1-23.

Three of the top four region-specific disadvantages are related to labor market issues. Respondents ranked the shortage of local skilled labor as a very significant disadvantage. In particular, the region seems to lack marketing and sales skills as well as managerial talents with local industry leaders indicating that marketing skills may be lacking the most. This may also be reflected in the nature of the entrepreneurs themselves. As noted earlier, the most common background of the founders was related to research and development and only a few had a background in marketing and sales. This critical shortage of labor that is necessary to grow a firm to scale may also explain why few startups in the region have reached scale and prominence (in the form of an initial public offering for example). Several interviewees lamented the fact that Boise's high-technology economy has not produced very many large and successful firms. Difficulty in accessing local sources of capital/financing was rated second. Issues related to cost of housing or the availability of office space seem to not hinder firms. In addition, firms seem to not have an issue with manufacturing and the availability of business services. Both indicate that the region has developed a mature business environment that offers possibilities for outsourcing and contracting to entrepreneurs.

## Conclusions

Boise, Idaho, represents a fascinating case study how a small metropolitan region can bootstrap a high-technology economy. The research illustrates that regions like Boise can grow technology-based industries in the absence of a world-class research university such as MIT or Stanford. The region leveraged the presence of large high-technology firms that functioned as incubators for startups, attracted talent, and created innovative products and services.

However, regional policymakers need to be aware that today's economy is very different from the one that was in place when Hewlett-Packard decided to set up a branch operation in Boise and when Micron Technology was founded. Unlike the 1970s when high-technology industries such as consumer electronics and semiconductors experienced tremendous growth and Silicon Valley-based firms expanded in states other than California, today's economic realities are different: Firms like Micron and HP increasingly look to low cost locations outside the United States. While they still retain a significant presence – primarily related to their R&D efforts – in U.S. states like Idaho, they are interested not only in exploiting low cost but also being near growing consumer and labor markets in countries like China and India. Retaining the presence of Micron and HP in Boise will be necessary. However, relying on these firms is not sufficient. Another way to preserve and create high-technology jobs is through the creation of startup companies.

Regional policymakers need to recognize that future economic growth heavily depends on the success of entrepreneurial startups and the ability to develop, attract and retain talent. They need to support entrepreneurship, university-industry connections, workforce development, talent creation, and the region's quality of life. Technology-based industries will be critical for future growth for any region and Boise needs to recognize that it already has the right prerequisites to succeed in a knowledge economy.

To take the region to the next level, policymakers need to focus and make strategic investments in their universities. Specifically they need to invest in R&D and develop funding mechanisms that leverage existing industry R&D capacities. States around the country have developed R&D investment funds that are aimed at leveraging industrial and federal R&D. Policymakers also need to focus on developing, attracting, and retaining talent. Boise and the State of Idaho may want to take

note what other states are doing. We suggest that in the short-term, Idaho takes the following steps:

### 1. Invest in R&D and Support Industry-University Linkages

State and local policymakers should be proud of Boise's high-tech success story, but they cannot rest on their laurels. Policymakers have to realize that the region and the state face serious competition from other states and other countries. The creation of new ideas and innovation are keys to future competitiveness and strategic investments need to be made.

In 2007, the National Governors Association and the Pew Center on the States published a report about state R&D investments. *Investing in Innovation* reviews what states are doing to increase R&D activities.<sup>9</sup> The report finds that in an era of declining federal funding and increasing industry R&D investments, states proactively support their universities in forging partnerships with industry and leveraging a larger share of the declining federal R&D dollars. To do this successfully, states like Idaho need to have an innovation strategy. Idaho was not mentioned in the report because compared to other states Idaho has fallen short on making strategic investments in its postsecondary education system. Policymakers should take note of the success stories unfolding in similarly sized and positioned states:

- *West Virginia*: The mountain state is experiencing a "research renaissance." Since 2001, West Virginia has restructured the EPSCoR program (which was plagued by parochialism and a funding cut) and successfully attracted \$18 million in NSF funding. In addition, the state instituted the Research Challenge Trust Fund, a competitive source of funding for university-industry R&D. The fund has already led to the creation of 4 startup companies. Unique about the fund is its funding mechanism: 0.5 percent of the state's racetrack lottery dollars support the effort on an annual basis. So far, the state has received approximately \$4 million per year in 2005 and 2006.
- *North Dakota*: In 2002, Governor Hoeven initiated "Centers of Excellence," specialized R&D institutes that foster university-industry partnerships. The Centers are funded by public and private dollars with at least two dollars of private money for every public dollar. The centers focus on niches such as agbiotechnology, surface protection, life science, unmanned aerial vehicles and petroleum safety and technology. An important catalyst in the efforts was the Roundtable on Higher Education, which brought together private sector leaders, university and legislative leaders. One of the state's primary metrics of success is the percentage of kids graduating from North Dakota universities who stay in the state to work. Thus, the goal of the state's economic development efforts is to not only increase educational attainment but also to create jobs for the state's graduates.
- *Oregon*: Oregon's high-technology economy grew in similar ways as Boise's. Two firms – Tektronix and Intel – functioned as "surrogate universities" and catalyzed high-tech growth. Universities and state investments in higher education always lagged behind the industry's growth and needs. In 2001, the state established the Oregon Council for Knowledge and Economic Development, a public-private effort that is now known as Oregon InC (Oregon

<sup>9</sup> National Governors Association and Pew Center on the States (2007). *Investing in Innovation*. Retrieved August 27, 2007, from <http://www.nga.org/Files/pdf/0707INNOVATIONINVEST.PDF>.



Innovation Council). The Council suggested to establish so-called “signature research centers” where university and industry would work together on basic and applied research. The first center – the Oregon Nanoscience and Microtechnology Institute (ONAMI) – was funded with \$21 million in state investments. The 2007 initiatives include recommendations for investments in new industries such as alternative energy (wave energy industry) but also in traditional industries such as manufacturing and food processing.

Idaho’s policymakers need to be bold and make similar investments in R&D. Boise State University has come a long way. The University of Idaho is also an asset. To leverage these two institutions, state leaders need to invest in them and they need to encourage them to collaborate with each other and with industry.

## **2. Develop, Attract and Retain Talent**

Boise’s success as an emerging high-technology region would not have been possible without the talent that HP and Micron attracted. These world-class firms were able to recruit the best and brightest from across the nation and the world. They in turn started companies and created jobs. Prominent local startups such as Extended Systems, M2M Communications, Dedicated Devices, Memjet, etc. were started by those who were attracted to the region by these firms.

Boise ranks low in educational attainment compared to similarly sized and located metropolitan areas and survey results indicate that the region’s startup companies suffer from a lack of skilled labor. A region’s or a state’s economic performance (as measured for example by income) is strongly correlated with educational attainment. It is therefore imperative that policymakers invest in developing, attracting and retaining talent, both at the K-12 and at the postsecondary levels.

*Developing talent:* Idaho needs to invest in education. Many states are investing in education and are offering opportunities for students to get financial assistance. Here are just a few examples:

- *Maine:* The state provides tax credits for graduates who spend all four years in the state’s university or community college system. Employers can assume the loan and get tax credit.
- *Ohio:* The Choose Ohio First Scholarship is a \$100 million program that encourages Ohio students to study science, technology, engineering or math.

*Attracting & retaining talent:* Idaho needs to leverage its quality of life to attract and retain talent.

- *Portland, Oregon:* Portland has become a very attractive location for 25 to 34 year-olds and the region is a net-gainer for this demographic group, a highly desirable group because 25 to 34 year-olds will settle in a place and become a valued labor pool. The region pays close attention to maintaining high quality of life and is a pioneer in urban planning and growth management. Talented people value mixed-use neighborhoods, lively urban centers, walkability, public transportation, distinctive businesses and local economies, and opportunities to participate in the politics of the place.

In conclusion: If Boise wants to continue its success story, local and state policy makers need to roll up their sleeves and get to work!

**Table 15: Region-Specific Advantages for Firm Development**

“How important have the following been to your firm's development?”

Regional Support Issue	N	Mean Rating	% Somewhat & Extremely Important	% Extremely Important
Attractive local quality of life for staff and management	96	4.28	84.38%	51.04%
Informal local access to innovative people, ideas, technologies	95	4.16	88.42%	37.89%
Local availability of managerial/professional staff	96	3.57	56.25%	26.04%
Access to local business services	95	3.49	58.95%	9.47%
Availability of appropriate local premises	96	3.39	47.92%	13.54%
Credibility, reputation & prestige of Boise as a high-tech location	95	3.34	50.53%	13.68%
Proximity to local customers	96	3.21	51.04%	21.88%
Access to local sources of capital, finance	95	3.12	38.95%	17.89%
Access to international airports	94	3.11	42.55%	13.83%
Supportive local government services	96	3.09	43.75%	9.38%
Proximity to local suppliers, subcontractors	96	3.09	42.71%	10.42%
Quality of local research staff	95	3.04	33.68%	11.58%
Supportive local training organizations	96	3.04	41.67%	9.38%
Local availability of research staff	96	2.98	33.33%	8.33%
Local shareholders	96	2.78	30.21%	10.42%
Research links with other firms or organizations in region	96	2.70	33.33%	9.38%
Access to Silicon Valley	95	2.61	28.42%	6.32%
Research links with BSU	96	2.58	29.17%	6.25%
Research links with other ID-based universities	95	2.22	16.84%	3.16%

Note: Issues ranked by mean rating. Rating scale was from 1 to 5 with 1 indicating completely unimportant and 5 indicating extremely important. Source: Boise Survey

**Table 16: Region-Specific Disadvantages for Firm Development**

“Have any of the following constrained your firm's development?” (N= 91)

Constraint Factors	Mean Rating	% Somewhat & Extremely Important	% Extremely Important
Shortage of local skilled labor	3.66	62.6%	29.7%
Difficulty in accessing local sources of capital, financing	2.90	34.1%	16.5%
Shortage of local marketing and sales skills	3.00	33.0%	13.2%
Shortage of local managerial skills	2.85	28.6%	7.7%
Lack of local subcontractors	2.82	28.6%	3.3%
Shortage of local semiskilled labor	2.70	26.4%	5.5%
Lack of world-class research university	2.75	25.3%	7.7%
Shortage of research skills	2.70	23.1%	7.7%
Cost of premises locally	2.42	16.5%	4.4%
Inadequate local business services	2.40	12.1%	3.3%
Inadequate/costly environment for manufacturing	2.16	7.7%	1.1%
Lack of appropriate premises locally	2.07	6.6%	0.0%
Housing problems for staff	1.99	5.5%	0.0%

Note: Ranked by mean rating. Rating scale was from 1 to 5 with 1 indicating completely unimportant and 5 indicating extremely important.

Source: Boise Survey

## Appendix

**Table 17: Evolution of Boise Support Infrastructure**

Year	Significant Event in the Formation of Boise's Innovation Milieu
1973	Hewlett-Packard selected Boise (over Spokane and Salt Lake City) as a branch location.
1978	Four Idaho natives start a semiconductor company called Micron Technology.
1984	Boise's HP operation was linked to Chico State University's long distance education network and they began offering Master of Computer Science degrees.
1986	Idaho Small Business Resource Center opens.
1995	BSU Semiconductor Technology Program starts.
1996	BSU College of Engineering is established.
1998	BSU graduates its first engineering students.
1999	Idaho Science and Technology Advisory Council was established by an executive order from Governor Kempthorne.
1999	Intermountain Venture Forum starts to invest in Boise.
1999	Stellar Technologies, an investment holding company headquartered in Boise, forms. It holds about \$130 million investments in startup companies with some located in Idaho.
1999	Akers Capital, one of the first local venture capital firms, forms.
2000	State released the <i>Idaho Science and Technology Strategy</i> .
2001	Highway 12 Ventures opens its headquarter office in Boise.
2001	Kickstand, an entrepreneurial networking group, starts to meet regularly.
2002	TechConnect starts. It has four offices in Idaho and serves entrepreneurs as a resource center.
2003	Delta Angels serves Idaho's major metropolitan areas and is formed by a coalition of investors.
2003	TechLaunch starts and is operated by TechConnect. It provides entrepreneurs the opportunity to present their business plans to potential investors.
2003	TECenter opens. The Technology and Entrepreneurial Center serves the region as an incubator.
2003	Micron Technology announced a 10 percent cut in its workforce.
2004	Idaho's Office of Science and Technology opens. It serves the state as a resource for science and technology and is housed in the Department of Commerce.
2004	Bioldaho is formed.
2004	Boise Angel Alliance is formed and consists of a group of accredited angel investors.
2005	S&T Advisory Council issues its subcommittee reports to Governor Kempthorne.
2005	State Tax Break Bill passes.
2006	Legislature rejects Kempthorne's recommendations.
2006	Boise Young Professionals group forms.
2007	Boise Keiretsu Forum starts.
2006	S&T Advisory Council's recommends investments in science and technology for about \$38.8 million (the total package of \$50 million includes tax breaks for investments in high-tech and biotechnology).
2007	BSU receives \$12.5 million from Micron Technology.
2007	Governor Otter makes recommendations to invest in traditional industries such as agriculture and dairy but not in high-tech.
2007	Governor appoints James Ellick, a Silicon Valley semiconductor veteran, to head the Department of Commerce.
2007	Boise Angel Fund established. The fund has \$800,000. A group of 15 Boise-based investors joined with Minnesota-based RAIN Source Capital to form the Boise Angel Fund.
2007	Voters approved a ballot initiative to establish a community college district in the Boise metro area.
2007	Following a huge loss and a downturn in the memory market, Micron announces layoffs.
2008	Governor Otter announced his intention to disband the Governor's Science and Technology Advisory Council.
2008	Representatives from the private sector form the Idaho Innovation Alliance. The effort is led by TechConnect.
2008	Governor Otter suggests removing one-time funding of \$300,000 for TechConnect Centers. He also suggests \$10 million toward a new \$35 million research center at Boise State University of support activities involving environmental science and economic development.

Source: Author's research

## About the Author

Dr. Heike Mayer is an assistant professor in the Urban Affairs and Planning program at Virginia Tech's Alexandria Center. She studied at the University of Konstanz (Germany) and received a master's degree and Ph.D. in Urban Studies from Portland State University in Oregon. Her research interests focus on the factors shaping the economic competitiveness of cities and regions. In particular, she examines the internal strengths a city or a region has to develop its economy, leading to so-called endogenous development. Heike focuses on three themes, each addressing certain aspects of the endogenous potential: 1) knowledge regions, 2) entrepreneurship and 3) place-making and competitiveness in small towns (with Dr. Paul L. Knox). She is currently writing a book about second tier emerging high-tech regions and is conducting case studies of Portland (Oregon), Boise (Idaho), Kansas City, and Phoenix. Heike's research has been funded by a variety of institutions such as the Smith Richardson Foundation, the Kauffman Foundation, The Brookings Institution, the Small Business Administration, Virginia Economic Development Partnership, and Arlington County, Virginia. Her work has been published in the *Journal of the American Planning Association*, *Journal of Urban Affairs*, *Economic Development Quarterly*, *Economic Development Journal*, and by the *Brookings Institution*. Heike co-directs the *Economic Development Studio @ Virginia Tech* (with Dr. John Provo). She is a native of Germany and she enjoys whitewater kayaking, traveling, and hiking.

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[http://www.nvc.vt.edu/uap/research/knowledge\\_regions.html](http://www.nvc.vt.edu/uap/research/knowledge_regions.html)

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