

Innovation in Colorado and the West Midlands

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Introduction

This report parallels the Colorado Innovation Network's annual Innovation Report¹ in providing an overview of innovative economic activity in Colorado, and extends the analysis to include the West Midlands region of the United Kingdom. While broader in geographic scope, this report provides a less detailed evaluation of the level of innovation in these two areas, aiming to give a snapshot of how Colorado and the West Midlands compare to other regions in their respective countries in terms of a few key metrics.

Innovation can be defined as a product, process, or service that generates new value in the market. The outcome of innovation could be a physical product, or something less tangible such as a new way of isolating proteins for genetic research. Innovation is difficult to measure directly, so we separately measure four key components of innovation: *talent*, *ideas*, *capital*, and *entrepreneurship*. The first three components – talent, ideas, and capital – are necessary to produce 'raw' innovation, while entrepreneurship represents the refining and matching process required to transform raw innovation from concept into reality.

Innovation is an important facet of economic growth in the US and UK, but it is not evenly distributed across regions of those countries. We use publicly available data compare Colorado to other innovative states² in the US, and to compare the West Midlands to other UK regions³ in terms of the four components of innovation. Specifically, we use higher education enrollment as an estimate of talent; patents per capita for ideas; venture capital investment for capital; and the number of startups for entrepreneurship. None of these measures completely encapsulate their components of innovation, but they are useful in comparing Colorado and the West Midlands to other areas in their respective countries.

In the US, we see that Colorado compares favorably to reference states in terms of patents, education, and number of startups, but lags behind in availability of venture capital. The West Midlands region, meanwhile, is above average in terms of the

¹ <http://www.coloradoinnovationnetwork.com/>

² The "peer group" of states against which we compare Colorado's innovation consists of Arizona, California, Massachusetts, New York, North Carolina, Texas, and Utah. These reference states are generally considered to have high levels of innovative activity.

³ When possible, we use data for all regions of the UK; in some cases, data are limited to regions within England.

number of startups, roughly average in terms of education, but falls below the UK average with regards to venture capital and patents.

A Note on Classifying Enterprises

This report includes data on a variety of different types of business enterprises. *Firms* are companies that employ at least one person aside from the owner(s). Firms may constitute more than one location; each of these locations is known as an *establishment*.

Startups refer to firms that have been in existence for less than one year⁴. The density of startups in an area can be measured either in terms of startups per capita, or as a proportion of total firms in an area. Due to data availability, US startups are measured in terms of startups per 1000 total *firms* in the state, while UK startups are measured as startups per 1000 *residents* of the region.

Innovation Part I: Talent

Innovation doesn't occur without talent. A talented workforce is essential to generating new ideas, and also attracts the entrepreneurs and financial capital required to translate ideas into successful businesses.

One central component of talent is education. (Talent can also come in from outside the region through net immigration of talented workers.) Higher education can give potential innovators both the scope of general knowledge to understand markets and find market niches, and the technical skills to turn innovative ideas into successful practices. As the economies of the world's most developed countries become increasingly skill-based, education becomes even more important for the workforce as a whole, and for potential innovators in particular.

The percent of young adults pursuing higher education is an important measure of talent because it is indicative of the current educational climate of the area, and also of the *future* talent in the region once those students complete their education.

Colorado and the West Midlands both fall very close to their respective national averages in terms of the percent of college-aged populace enrolled in secondary education. Interestingly, though, Colorado has an exceptionally high percentage of residents with at least a bachelor's degree, due to a large number of highly educated people choosing to move to the state.

⁴ Ewing Marion Kauffman Foundation, "The Kauffman Index – State Rankings." Web: <http://www.kauffman.org/microsites/kauffman-index/rankings/state?Report=StartupActivity&Indicator=SRank>

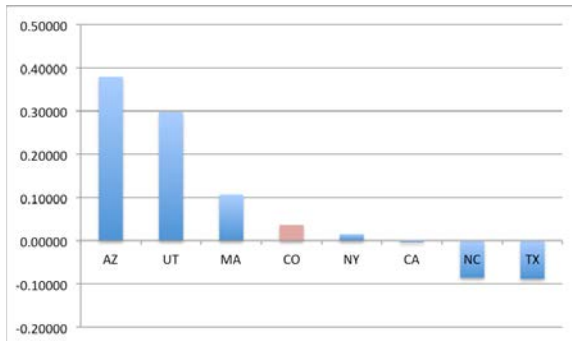


Figure 1: Proportion of Adults 19-25 Enrolled in Post-Secondary School Compared to US, 2015

Data source: National Center for Education Statistics, "Digest of Education Statistics: Total fall enrollment in degree-granting postsecondary institutions, by state or jurisdiction." Web: http://nces.ed.gov/programs/digest/d15/tables/dt15_304.10.asp?current=yes

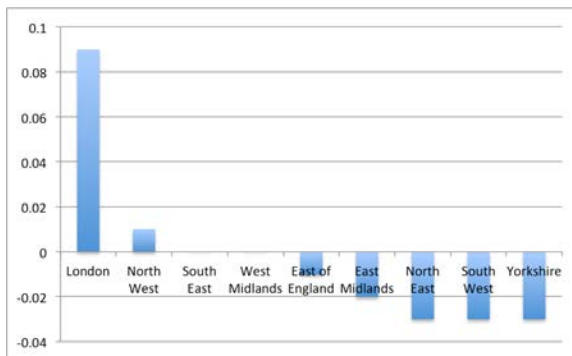


Figure 2: Proportion of Pupils Entering Higher Education Compared to England, 2011-2013

Data source: Department of Business Innovation & Skills, "Widening Participation in Higher Education, July 2015." Web: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/443986/Widen-Partic-HE-2015s.pdf



Figure 3: Proportion of Adult Population with at least a Bachelor's Degree Compared to the US, 2015

Data source: US Census Bureau, "Current Population Survey." Web: <http://www.census.gov/cps/data/cpstablecreator.html>

II: Ideas

The next requisite component of innovation is good ideas. Innovation requires doing something new, be it a new product, service, design, or some combination thereof.

One way to measure ideas is to look at patents. Patents are legal protections granted to businesses or individuals who generate a novel idea. This legal protection allows those with new ideas to profit from the ingenuity. In this way patents themselves

are a crucial piece in the innovation puzzle. Patent records also provide insight into where ideas are being generated. It should be noted that businesses or individuals might choose not to patent an idea for a variety of reasons, so the data presented here only tells part of the idea-generation story.

Compared to the national average and to most key reference states, Colorado produces a high number of patents per capita – about 50% more patents per million residents than the national average. In sharp contrast, the West Midlands currently sits second-lowest among UK regions in patents per capita, generating about half as many patents per million residents as the whole of the UK on average.

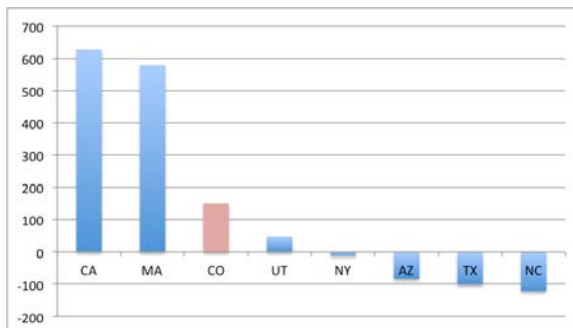


Figure 4: Patents per Million Residents Compared to US, 2015

Data source: US Patent and Trademark Office, Patent Technology Monitoring Team, "Extended Year Set – Patent Counts by Country, State, and Year, All Patent Types (December 2015)." Web: http://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_allh.htm

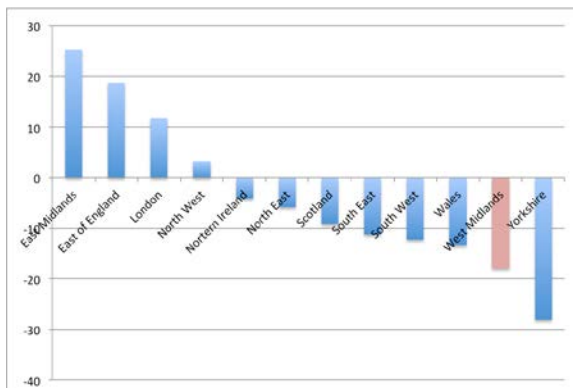


Figure 5: Patents per Million Residents Compared to UK, 2013

Data source: Intellectual Property Office, "Facts and Figures, 2012 and 2013 Calendar Years." Web: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/318346/Facts_and_Figures.pdf

III: Capital

In order for would-be innovators to turn their ideas into successful innovation, most need access to financial capital to create prototypes and finished products; rent or buy office, manufacturing, or storefront space; hire consultants, services, or employees, and any number of other costly business operations.

Acquiring capital for an innovative venture is a unique challenge, since innovation by definition requires risk in the form of relatively unknown products, markets,

and/or practices. This inherent uncertainty can make it difficult for potential innovators to secure traditional bank loans. To thrive, innovative enterprises often require venture capital. Venture capital firms typically finance with equity, sharing in the risk and reward of innovation. This structure allows risky but promising innovators to get funding, and also frees them from a rigid structure of frequent and uncompromising loan repayments.

We measure the availability of innovation financing using the amount of venture capital investment made in 2015 by state or region. Colorado and the West Midlands both fall behind their respective national average in this regard, with the West Midlands bringing in about 10% less venture capital per resident compared to the UK average, and Colorado lagging more than 20% behind the US average. This is particularly striking for Colorado, which in 2000 was significantly above the national average level of venture capital per person⁵.

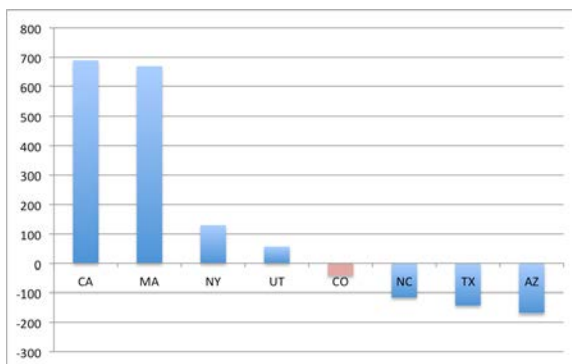


Figure 6: Venture Capital Investments (\$) Per Capita Compared to US, 2015

Data source: PricewaterhouseCoopers MoneyTree, "Investments by State." Web: <https://www.pwcmoneytree.com/CurrentQuarter/ByState>

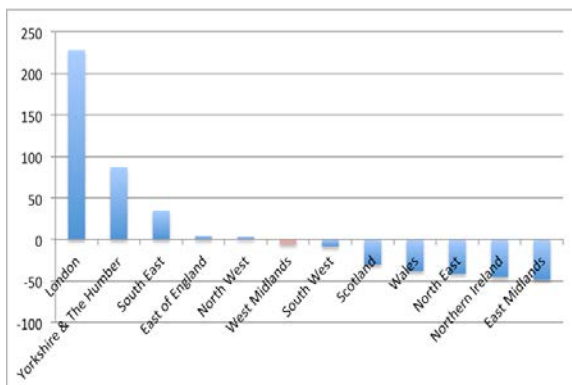


Figure 7: Venture Capital Investments (£) Per Capita Compared to UK, 2015

Data source: British Private Equity & Venture Capital Association, "BVCA Private Equity and Venture Capital Report on Investment Activity 2015." Web: <http://www.bvca.co.uk/Portals/0/library/documents/BVCA%20RIA%202015.pdf>

⁵ Colorado Innovation Network, "The 2012 Colorado Innovation Index – Reaching our Innovation Summit." Web: http://www.coloradoinnovationnetwork.com/wp-content/uploads/2016/07/2012_Innovation_Report.pdf

IV: Entrepreneurship

Finally, in order for innovation to occur, there must be willingness to take the risk of starting a new business. Entrepreneurs translate talent, ideas, and capital into marketable products. They play the crucial role of recognizing and refining good ideas, finding a niche in existing markets (or seeing the potential for a new market), and organizing the production of the final good, service, or process.

One way to track entrepreneurship is to look at the number of startups in a region. Innovation can occur outside of startups, and not all startups are innovative. But innovation can catalyze startup activity, which is a major driver of growth in the US and UK: in the US, startups created 2.5 million jobs in 2014⁶; in the UK, over 600,000 startups formed in 2015⁷, which is significant since enterprises with under 250 workers make up 60 percent of total employment⁸. And even when startups fail, they provide valuable information about the market to others⁹.

Colorado ranks highly among reference states for startups per 1000 firms. The West Midlands is also slightly above average in terms of startups per capita. More encouragingly, setting aside the urban London region, the West Midlands is roughly on par with the next-highest ranking regions for startups per capita.

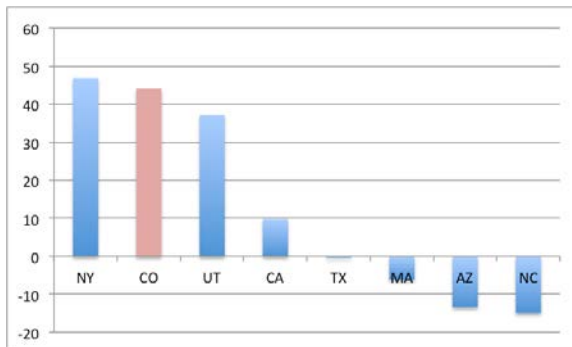


Figure 8: US Startups per 1000 Firms Compared to US, 2015

Data source: Ewing Marion Kauffman Foundation, "The Kauffman Index – State Rankings." Web: <http://www.kauffman.org/microsites/kauffman-index/rankings/state?Report=StartupActivity&Indicator=SRank>

⁶ US Census Bureau, "Measuring America: Startups and Job Creation in the United States." Web: <https://www.census.gov/library/visualizations/2016/comm/startups-jobs.html>

⁷ Startup Britain, "Startup Tracker." Web: <https://www.census.gov/library/visualizations/2016/comm/startups-jobs.html>

⁸ Department of Business Innovation & Skills, "Statistical Release - Business Population Estimates for the UK and Regions 2015." Web:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/467443/bpe_2015_statistical_release.pdf

⁹ Buntten, Weiler, Thompson, and Zahran, "Entrepreneurship, Innovation, and Growth." Journal of Regional Science, Oct. 2014.

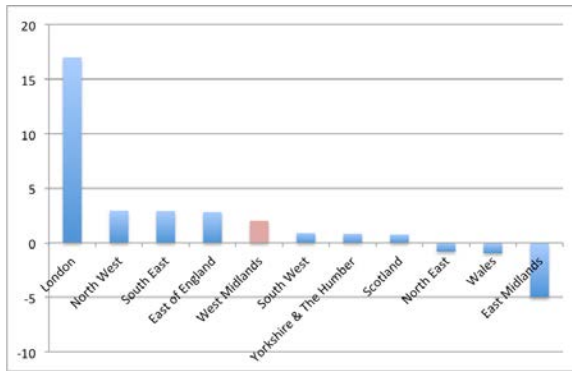


Figure 9: UK Startups per 1000 Residents Compared to UK, 2015

Data source: Startup Britain, "Startup Tracker." Web: <http://startupbritain.org/startup-tracker/>

Summary of Key Findings

Innovation is a multifaceted phenomenon, requiring talent, ideas, capital, and entrepreneurship to thrive. In combination, these components can catalyze growth and employment.

Colorado and the West Midlands both exceed national averages in some elements of innovation, and fall short in others. This could be seen as evidence that with improvements in one or two key metrics, both of these areas could increase the breadth and depth of innovation occurring within their borders.

This report indicates, albeit with a fairly limited number of measures, that relative to its peers, Colorado has a talented workforce and high numbers of patents and startups per capita, but a relative scarcity of venture capital. The West Midlands exceeds the national average for startups per capita, is close to the average in terms of education, but falls short in terms of patents and venture capital.