THE EMERGENCE OF AN INNOVATION CLUSTER IN THE VALUE CHAIN OF COLORADO AGRICULTURE: CONSUMER IMPLICATIONS

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Two converging forces changing the nature of innovation in agriculture and food:

1. Increasing complexity and interdependence of innovations within the industry value chain

2. Increasing concentration of innovation activities geographically within regional “clusters”
Prompting a recalibration of perceptions and policies:

1. Viewing the industry value chain holistically. Rather than single commodities or sectors.

2. Recognizing (facilitating) the concentration of innovation within regional “clusters”
   – Tend to converge where population is concentrated
Case Study: The Value Chain of Colorado Agriculture

VIEWING THE VALUE CHAIN HOLISTICALLY
Provides a comprehensive foundation of data on Colorado’s agriculture, food, beverage, green industries, in order to...

- Identify areas where businesses share a common fate
- Bring Colorado’s regions together around shared economic strengths
- Provide an integrated perspective to inform policy and regulatory decision-making across all segments of the value chain
- Highlight connections to allow for a deeper understanding of agriculture and its impacts on Colorado
- Create a new conversation about Colorado agriculture
The value chain of agriculture

- Crop resources
  - Land resources
  - Water resources
  - Livestock resources
- Crop production
  - Crop genetics
  - Pest control
- Livestock production
  - Equipment
  - Energy
  - Animal health & vet care
- Crop processing
  - Equipment
- Bioenergy feedstock
- Feed & fodder
- Meat
- Dairy
- Intermediate ingredients
- Processing, packing, bottling
- Biofuels production
- Crop processing (sorting, milling, pressing)
- Food crop harvests
- Bioenergy feedstock
- Feed & fodder
- Meat
- Dairy
- Intermediate ingredients
- Processing, packing, bottling
- Biofuels production
- Crop processing (sorting, milling, pressing)
- Food crop harvests
- Open spaces, ecosystem services, wildlife habitat, etc.

- Fresh market
- Food & beverage manufacturing
- Fuels blending
- Food & beverage retail stores
- Food & beverage service
- Other retail
- Consumers
The Reality of Colorado Retail

Total retail sales of $27.5 billion

- Food at home = $12.3 billion
- Food away from home = $13.9 billion
- The big six = $8 billion
  - Full service restaurants = $5.8 billion
  - Alcoholic bev. = $2.9 billion
  - Pet food = $180 million
  - Garden center, landscaping = $1.2 billion
- "Locally grown" = $88 million
Case Study: The Emergence of an Innovation Cluster in Colorado

RECOGNIZING REGIONAL CONCENTRATION OF INNOVATION
The Emergence of an Innovation Cluster in the Agricultural Value Chain along Colorado’s Front Range
(October 2014):
- Recognizes the emergence of an innovation cluster in agricultural value chain
- Empirically derive its geographic footprint
- Explore the economic fundamentals driving its growth
- Identify the main technology categories and interrelationships among them.
- Take an inventory of the companies and organizations
- Recommend next steps
What is an *innovation-led industry cluster*?

“A geographically proximate group of interconnected companies and associated institutions in a particular field, linked by various commonalities and complementarities.”

Michael Porter
Harvard Business School

“Co-location of different stakeholders accelerates knowledge-sharing and development of new products and services in ways that you can’t do if they’re scattered.”

Navi Radjou
University of Cambridge
Judge Business School
THE GEOGRAPHIC FOOTPRINT OF INNOVATION IN FOOD AND AG IN COLORADO
Exploring Colorado’s science base

We searched Web of Science database for

- CO authors
- In fields of:
  - Agriculture
  - Agronomy
  - Entomology
  - Horticulture
  - Plant Science
  - Soil Science
  - Veterinary Science
  - Food
  - Water

→ 14,982 scientific articles published 1990-2012
Location of authorship on scientific publications in agriculture and food
Exploring Colorado’s technology base

We searched the U.S. Patent Office database for

- **CO** inventors
- In fields of:
  - Agriculture
  - Food
  - Veterinary
  - Milling/Slaughtering/Processing
  - Packaging/Storing/Handling
  - Biofuels
  - Water treatment
  - Hydrology/Water

**5,005** patents issued 1990-2012
Location of authorship on scientific publications in agriculture and food

Location of invention on US patents in agriculture and food
WHY THE COLORADO FRONT RANGE?
Colorado has a long history in ag, food, and beverage innovation and entrepreneurship:

- Coors, 1873
- Monfort, 1930
- Leprino, 1950
- Celestial Seasonings, 1969
Colorado consistently ranks nationally in innovation and entrepreneurship

- No. 2 in the U.S. for entrepreneurship and innovation (U.S. Chamber of Commerce, 2013)
- No. 4 in the State Technology and Science Index (Miliken Institute, 2013)
- No. 5 for entrepreneurial activity (Kauffman Foundation, 2014)
- Top 10 Metro Areas in the U.S. for High-Tech Startup Density (Kauffman Foundation, 2013, based on U.S. Census Bureau):
  1. Boulder, CO
  2. Fort Collins-Loveland, CO
  6. Denver, CO
  9. Colorado Springs, CO
Why the Colorado Front Range?

66% of Colorado population
11% of Colorado area

12% of Colorado farmland
30% of value of ag production
51% of value of ag inputs

81% of value of commodity marketing/processing

95% of scientific publications and 90% of patented inventions in ag, water, food, beverage, biofuels.

Most of the innovating companies. Most of the research institutions.
CATEGORIES OF AG AND FOOD TECHNOLOGIES IN WHICH COLORADO COMPANIES ARE INNOVATING
Colorado’s innovators concentrate in a dozen interrelated technology categories. Advances in one area creates new opportunities in others.
Colorado’s innovating companies and institutions in commodity processing and food and beverage manufacturing:

**COMPANY**
- Atlas Pacific Engineering
- Ball Corp
- Cargill - Meat Solutions
- Celestial Seasonings
- ConAgra Mills (Ardent Mills)
- DSM
- JBS
- Keen Ingredients
- MicroTender Industries
- Penford Food Corporation
- Western Sugar Cooperative
- WhiteWave - Horizon Dairy

**CITY**
- Pueblo
- Broomfield
- Fort Morgan
- Greeley
- Boulder
- Commerce City
- Denver
- Centennial
- Broomfield
Colorado’s innovating companies and institutions in dairy production and manufacturing


CITY: Boulder, Denver, Windsor, Aurora, Broomfield, Bellvue
Colorado’s innovators in analytics, testing, and biosafety

COMAPNY INNOVATIONS

Analytical Spectral Devices
Bintech
Birko
CarboAnalytics
Chroma Dextran
Dairy Tech International
Gambro
Hach Company
Lumiere Diagnostics
MicroBac
OptiEnz
Thermo Fischer

CITY

Boulder
Louisville
Henderson
Fort Collins
Boulder
Windsor
Lakewood
Loveland
Fort Collins
Boulder
Fort Collins
Denver; Lafayette
Colorado’s innovating companies and institutions in beer, wine, and spirits.

- Anheuser Bush - Budwiser (Fort Collins)
- Colterris Winery (Grand Junction)
- Coors (Golden)
- Infinite Monkey Theorem (Denver)
- Jack Rabbit Hill (Hotchkiss)
- New Belgium Brewery (Fort Collins)
- Left Hand Brewing (Longmont)
- O'Dells (Fort Collins)
- Oskar Blues (Lyons)
- Spring 44 (Loveland)
- Stranahan's (Denver)
- Wynkoop (Denver)

...and many, many more.
Colorado’s innovating companies and institutions in “fast and fresh” food service

- Chipotle Mexican Grill
  - Mexican
  - Denver
- Einstein Noah Bagels
  - Bagels
  - Golden
- Larkburger
  - Burgers
  - Arvada
- Live Basil
  - Pizza
  - Denver
- Mad Greens
  - Salads
  - Golden
- ModMarket
  - Bistro
  - Boulder
- Noodles & Co.
  - Noodles
  - Broomfield
- Tokyo Joe's
  - Asian
  - Denver
- Qdoba
  - Mexican
  - Denver
Colorado’s innovating companies and institutions in natural and organic food and beverages

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<th>COMPANY</th>
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<td>Alfalfa’s</td>
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Discussion

• National trends in regional clustering
Next steps

0. Acknowledge the economic significance and technological sophistication of existing innovation activities in the agricultural and food value chain.
Next steps

1. Develop and attract talent.

Talent is identified repeatedly as the most important factor driving growth of an innovation cluster. Availability of specialist skills was the factor most commonly cited by executives interviewed for this study.
Next steps

2. Identify and support existing activities. Connect existing companies.

Much innovation is already under way that has arisen in response to market forces, and thus has real market potential. Look for grassroots developments and seek ways to accelerate them.

Growth of a cluster needs mechanisms to facilitate mixing and spawning collaborations between people and organizations. Especially important is the development of public-private collaborations.
Next steps

3. Exercise tolerance of different points of view.

Innovation often arises at the intersection between conflicting points of view and, by its very definition, is a challenging of the status quo. Innovation requires a willingness to question how things are done.

The agricultural and food system is often the focus of social and political contention over “how things are done”. Colorado is at the center of these national debates. Colorado innovators have an opportunity to take leadership and provide solutions.
Next steps


Given the complexity of the value chain vertical coordination may be required for piloting new technologies, test marketing new products, or implementing new business models.

Size of the local market was the second most important factor to executives locating R&D activities on the Front Range. The Denver metro region, at 3.1 million, is compact enough to be manageable for test marketing yet large enough to grow within substantially, before seeking to expand nationally and globally.
Next steps

5. Develop financing mechanisms to assure access to risk capital.

Regionally we need greater access to early-stage risk capital for proof-of-concept validation and to create and grow new innovative companies, up and down the ag value chain.

Drawing upon a combination of

• traditional small-business financing sources
• farm credit system (CoBank, FCC Services, American Ag Credit, etc.)
• venture capital funds
• angel investors

In particular, seek mechanisms to facilitate financial investments from farm and ranch families that need to diversify their estate’s investment portfolio in managing the transfer between generations.
Next steps

6. Take the long view.

This is a long term effort, measured in decades. It has already been building for almost two decades. It may take another decade of sustained effort to reach a level of maturity and dynamism that Colorado is recognized globally.
Discussion and implications

• Shifting innovation in the value chain
  – from supply driven (or ‘science pushed’) cost reducing innovation
  – To consumer oriented (or ‘demand pulled’) value increasing innovation
Questions?

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Report available online at:  
http://outreach.colostate.edu