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

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Consumer Issues Conference:
Food Perceptions, Practices, & Policies
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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
The Value Chain of Colorado Agriculture (Feb 2013)

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

- Land resources
- Water resources
- Livestock genetics
- Animal health & vet care
- Energy
- Equipment
- Fertilizer
- Crop genetics
- Pest control
- Crop production
- Livestock production
- Bioenergy feedstock
- Feed & fodder
- Meat
- Dairy
- Processing, packing, bottling
- Biofuels production
- Crop processing (sorting, milling, pressing)
- Intermediate ingredients
- Fresh market
- Food & beverage manufacturing
- Food & beverage service
- Processing, packing, bottling
- Other retail
- Fuels blending
- Open spaces, ecosystem services, wildlife habitat, etc.
- 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
An innovation-led industry cluster?

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 farm land
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

COMPANY
- DSM omega-3 and other food ingredients
- Leprino Foods Company - cheese manufacturing
- Dairy Tech Inc - pasteurization systems
- Aurora Organic Dairy - organic dairy
- WhiteWave - Horizon Dairy - dairy and soy beverages
- Noosa Yoghurt – Morning Fresh Dairy - Premium yoghurt; milk home delivery

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

COMPANY
Analytical Spectral Devices
Bintech
Birko
CarboAnalytics
Chroma Dex
Dairy Tech Inc.
Gambro
Hach Company
Lumiere Diagnostics
MicroBac
OptiEnz
Thermo Fischer

CITY
Boulder
Louisville
Henderson
Fort Collins
Boulder
Windsor
Lakewood
Loveland
Fort Collins
Boulder

Frequency
- 1
- 2
- 3
- 4
- 5

Sector
- Public/Nonprofit
- Private
Colorado’s innovating companies and institutions in beer, wine, and spirits:

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>TECHNOLOGY</th>
<th>CITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anheuser-Busch</td>
<td>brewing</td>
<td>Fort Collins</td>
</tr>
<tr>
<td>Colterris Winery</td>
<td>winemaking</td>
<td>Grand Junction</td>
</tr>
<tr>
<td>Coors</td>
<td>brewing</td>
<td>Golden</td>
</tr>
<tr>
<td>Infinite Monkey</td>
<td>winemaking</td>
<td>Denver</td>
</tr>
<tr>
<td>Jack Rabbit Hill</td>
<td>winemaking/distilling</td>
<td>Hotchkiss</td>
</tr>
<tr>
<td>New Belgium Brewery</td>
<td>brewing</td>
<td>Fort Collins</td>
</tr>
<tr>
<td>Left Hand Brewing</td>
<td>brewing</td>
<td>Longmont</td>
</tr>
<tr>
<td>O'Dells</td>
<td>brewing</td>
<td>Fort Collins</td>
</tr>
<tr>
<td>Oskar Blues</td>
<td>brewing</td>
<td>Lyons</td>
</tr>
<tr>
<td>Spring 44</td>
<td>distilling</td>
<td>Loveland</td>
</tr>
<tr>
<td>Stranahan's</td>
<td>distilling</td>
<td>Denver</td>
</tr>
<tr>
<td>Wynkoop</td>
<td>brewing</td>
<td>Denver</td>
</tr>
</tbody>
</table>

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

COMPANY
Chipotle Mexican Grill
Einstein Noah Bagels
Larkburger
Live Basil
Mad Greens
ModMarket
Noodles & Co.
Tokyo Joe's
Qdoba

CUISINE
Mexican
Bagels
Burgers
Pizza
Salads
Bistro
Noodles
Asian
Mexican

CITY HEADQUARTERED
Denver
Golden
Arvada
Denver
Denver
Boulder
Broomfield
Denver
Colorado’s innovating companies and institutions in natural and organic food and beverages

COMPANY
Alfalfa’s
Bhakti Chai
Boulder Brands (Smart Balance, Evol, Udi’s)
Celestial Seasonings
Fresca Foods
Good Belly
Keen Ingredients
Larabar
Lifeline Nutraceuticals
Madhava Natural Sweeteners
MicroPure Technologies
Natural Grocers
Rudi’s Bakery
White Wave

CITY
Boulder
Boulder
Boulder
Boulder
Louisville
Boulder
Denver
Denver
Englewood
Longmont
Fort Collins
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.
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.
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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