



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

A Path Dependency and Cluster Competitiveness Framework to Examine Regional Marketing Systems and Conflicts

Timothy Woods and Roberta Cook

This paper develops a framework for competitiveness that incorporates path dependency within production regions. Patterns of technological innovation, product development, institutions, and market orientation follow a certain local path. This evolution creates regional economies that emerge with unexpected competitive advantage. The model draws on previous work looking at, among other things, induced innovation. The framework is applied here to the major regional tomato producers in North America. The paper examines the role of various institutions (grower associations, governments, research institutions, and support industry) in influencing the path along which a regional sector evolves.

Key Words: competitiveness, induced innovation, path dependency

JEL Classifications: Q13, Q16, Q17

The produce marketing system in North America has been undergoing considerable change. This change is exemplified by the recent antidumping lawsuits and countersuits filed by tomato growers in Canada and the United States. Several rounds of suspensions have evolved, but the competition between production regions has been well documented (*Federal Register*). This recent row falls just on the heels of the NAFTA debate where the U.S. winter vegetable growers took exception to trading practices by Mexican growers. The debate and tensions in the marketplace continue in earnest as regional grower groups try to preserve their markets and competitive position.

Many of the trade discussions focus on anticompetitive behavior, level playing fields,

cost of production differences, and like product analyses. These matters are important, and reasonable justification can be made for implementing rules that facilitate orderly market development. Much of this debate, however, looks at static price and production conditions. There is much to be added to the discussion by digging deeper to better understand the dynamics of competitiveness and how institutions contribute to this evolution. There appears often to be a path along which unique resources are developed and a sense in which, because of search costs and market focus, key resources that define competitiveness are developed regionally.

This paper looks at the dynamics of resource development and competitiveness for four tomato production regions. Porter's concept of competitive clusters is examined, along with some perspectives drawn from some recent papers by Vernon Ruttan (1996, 1997) on induced innovation and applied to the context of these production regions. A discussion

Timothy Woods is associate professor, Department of Agricultural Economics, University of Kentucky, Lexington, KY. Roberta Cook is professor, Department of Agricultural and Resource Economics, University of California–Davis, Davis, CA.

about the role of institutions follows, including observations about differences in institutions in these regions.

Regional Production Clusters

The tomato industry in North America has followed an interesting path of development. The steady increase in the demand for tomatoes in the United States, Canada, and Mexico created great opportunities for producers in a number of different areas. Florida came to eventually dominate as a production region for the winter months and developed a production system that emphasized growing mature green tomatoes in the field that could endure wide distribution. Florida continues to be the largest fresh tomato production region, accounting for about 38% of the total shipments.¹ California was able to draw on its existing produce support industries to become an attractive production region in its own right. The market focus was slightly different from Florida, emphasizing the summer months and also growing vine-ripened products. California accounts for about 16% of the total shipments.

Mexico has been a significant production region for tomatoes since the early 1960s.² Exports to the United States steadily grew, approximately by a factor of three between then and now. A substantial export emphasis to the U.S. markets developed during the winter months, largely in competition with Florida. Within Mexico, areas focused their production further, depending on their factors of production and support institutions. Sinaloa emerged as the primary production region and continues to emphasize vine ripe tomatoes, whereas the California Baja is a lesser production area and emphasizes specialty tomato products such as roma varieties. Mexico accounts for about 35% of the total shipments into U.S. markets, including 70% of the roma type mar-

¹ Based on estimates provided by the *Vegetable Shipments by Commodities, Origins and Months* report, USDA-AMS, 2001, for all tomatoes. Florida accounts for about 45% of the standard size tomato.

² An extensive discussion of the Sinaloa vegetable cluster using the Porter framework for national competitive advantage is presented in Sparling and Cook.

ket, which has seen especially significant growth in recent years.

Canada has emerged as another important production region with a different focus. The Canadian greenhouse industry has expanded substantially, particularly in Ontario. Approximately half of the greenhouse production by value is for tomatoes. Although growers in this region continue to look for ways to extend their season, they still focus on the summer months when there is adequate light. The products marketed are aimed at the higher end premium packs and clusters. Although only 4% of the total shipments to U.S. markets come from Canada, many U.S. growers have become concerned about the rapidly growing production capacity and, especially, the competition for high-end markets. Production and value have tripled in Canada since 1996.

Each of these production regions is defined by quite different factors of production, technology, institutions, markets, and geographic proximity. The assets and opportunities for tomato production within each of these areas are quite different and are not easily transferred. Each region has competed in similar markets and been able to share certain technologies that have been developed, but because of asset and institutional specificity, each region has followed a unique path that has led them to their current position. Each region has a focus on the production of a (somewhat) similar product but is pursuing a share of the U.S. market with different resources. The market is large and complex, with segments having distinct demand characteristics. Opportunities are framed as temporal, geographic, income oriented, and channel oriented. Table 1 summarizes some of the differences in market orientation by each production region. There is opportunity for considerable direct competition between regions for some of these segments, but the general orientations are distinctive.

Regional Strategic Clusters and Innovation

The concept of economic clusters within industries that develop regionally and compete

Table 1. Product and Market Focus for Different Tomato Production Regions

Region	Product Focus	Market Focus in U.S.
Florida	Field-grown and mature green, predominantly standard size (86% of standard size share), some cherry and plum	Winter, foodservice, and retail
California	Field-grown, vine-ripened standard size, plum	Summer, retail
Canada	Greenhouse standard size, includes significant share of cherry tomatoes (30%), premium grade and pack, clusters	Summer, retail
Mexico	Field-grown, vine-ripened, includes significant share of cherry and plum (38%)	Winter, retail

Source: Share data based on USDA Shipments by Commodities, Origins, and Months 2001, March 2002.

to varying degrees with other clusters has been discussed at length by various authors and has been championed by Michael Porter. Such clusters form around shared assets and evolve around factor conditions, firm strategy, structure and rivalry, demand conditions, and related and supporting industries. Although Porter focuses his attention on national industries, presumably with a view toward national economic development policies, such clusters need not be bound by national geography. The micro and macro of the evolutionary dynamics can be drawn at any number of levels. The basic dynamics discussed by Porter have been present, for example, in Florida as opportunities and competitive advantage has developed within that production region. This evolution rises to another level when one considers other production regions competing for the U.S. tomato market.

Porter's discussion of these clusters, considering the Italian ski boot industry for example, reminds us that the dynamics of competition can create a regional industry with quite unique assets. The assets go well beyond simple factors of production such as labor and machinery. Unique local institutions are created, local management and marketing experience is created, and demand channels are developed where the region creates a reputation among buyers as a preferred and established source of supply.

Another factor that is also overlooked in regional competition is first mover advantage. The new product development literature looks

extensively at firm-level strategies to be first to market, the extent of the benefit, and how such advantages can be sustained (Brown and Eisenhardt).³ Although it is indeed true that firms compete and not regions, per se, as appropriately noted by Thompson and Wilson, there is still a sense of regional production advantages that are being pursued by many of the actors within the region.

This leads to an important premise: technology and other innovations, and thus regional competitive advantages, emerge uniquely out of regions not simply because one or the other was endowed with a certain initial stock of factors of production, but because many of the assets necessary to compete are created in the course of industry development. These assets include the technology to exploit certain factors of production and the development of local institutional innovations that are designed to create and sustain further advantages. Furthermore, many of these technology and institutional assets are not easily transferable.

Vernon Ruttan provides a thoughtful anal-

³ Porter also notes that, in the context of firm competition, those sourcing technology from other nations are always a generation behind. As he notes, "... the capacity to deploy technology is what leads to advantage, not mere access Competitive advantage is increasingly a function not of the factors but of the ability to create and apply knowledge and technology to industry competition" (Porter, 165). Regional institutions play a great role in both the creation and deployment of knowledge and technology.

ysis of recent theories of induced innovation and sources of technological change in several recent related papers (Ruttan 1996, 1997). Although expressing some concern about the limits of different theories of induced innovation, he nonetheless underscores the importance of economists gaining a better understanding of the forces that determine the sources, the rate, and the direction of technological change.

Ruttan reflects on the merits of theories that can help explain these aspects of technological change, including induced technological change arising from changes in factor prices; evolutionary theory that points to the sources of change as being (a) a local search for technological innovation, (b) an imitation of the practices of other firms, and (c) satisficing economic behavior; and, finally, path-dependent models. He recognizes that at least each of these theories challenges the neoclassical growth model assumption that a common production function is available to all countries (or regions) regardless of natural resources, physical or human capital, or institutions. His frustration with each theory is either that it is incomplete or difficult to develop empirical research. He also notes that often the high-impact technologies are not easily duplicated and are location specific with regard to their effect on productivity.

The points raised by Ruttan have direct bearing on the regional tomato situation. Each production region has quite a different story with regard to the development of their technology. The forces that determined the sources, rate, and direction of technological change have been different in each region and have created a distinctive set of competitive factors. The suggestion here is that, as will hopefully be demonstrated, the evolution of competitive advantage is not simply a story of technology, but of institutions and markets as well.

Certainly the technologies, such as greenhouses, extended shelf life varieties, drip irrigation, and fertigation have been able to be transferred to a certain extent between regions. But one also observes that each region has evolved to compete with these other regions at some level, albeit in sometimes somewhat

different markets, with a mix of resources uniquely developed within that region. The sources of change are very different in each place. In some cases, it is simply a matter of technology transfer between regions.⁴ But even in these cases, the technology is clearly adapted to fit local conditions.

The rate of change can also be quite different in each region. While Florida, California, and Sinaloa, Mexico, have been steadily developing production techniques within their regions over the past 35 years, the Canadian greenhouse industry has expanded at a much faster pace within the past 10 years. The developmental pace of the greenhouse industry has depended little on the pace of change in more traditional field-grown tomatoes.

There is also the matter of the direction of technological change. A key point within this whole discussion is that the trajectory of change is very different in each production cluster. A lot of it has to do with the fact that each region truly does have a different production function it employs to pursue different markets. There is also the matter of different demand-pull factors influencing each area. The premium and cluster tomatoes, the vine-ripened products, the mature greens, and the specialty tomatoes are similar but different. Furthermore, market windows are changing. Retailers are placing a premium on suppliers' ability to provide a year-around supply of product.⁵ Changes in the marketplace can stimulate the direction of technological change. As each cluster provides some leadership in the time, form, and space with respect to the products they are delivering to market, there is regularly a focus or a preference within that region on certain kinds of technologies that might be of lesser importance to producers in another region. There is a matter of search that takes place with most innovation. Ruttan reminds us that economists in the past (namely Schumpeter) have made

⁴ Florida, for example, is adopting some of the extended shelf life varieties so widely adopted in Mexico, which, in turn, were developed in Israel.

⁵ A number of studies have shown this pattern, including McLaughlin and Park.

the distinction between innovation and invention. There need not necessarily be a new invention, *per se*, to provide a solution to a problem or to improve on a current production system that might be in use. New management practices, new rules for trade, new mechanisms for gathering resources to overcome certain local externalities can all help move a local industry forward. Just the same, because regional clusters employ different assets to pursue related, but slightly different, market opportunities, the search process (i.e., how resources are directed to solve problems) is different in each area. This necessarily leads to a certain path dependency with regard to the trajectory of development. That's not to say that a great idea, like shelf life-extending tomato varieties or drip irrigation developed in one area can't be quickly adopted in another area. But not all innovations will have equal value for every regional situation.

The creation of key regional assets over time can be observed within the tomato production regions. The regional support institutions are also vital and distinctive assets that will be taken up later. The point to observe is that many of the assets observed regionally today developed over considerable time, were largely confined to the region in which they are now observed, and are combined with other immobile or specific assets to create the unique regional basis for pursuing opportunities in the market. The sources of advantage, summarized in Table 2, are not easily transferred. The result is that each region searches for innovation and opportunity that complements the current mix of assets, solves local problems, and thereby creates a unique path for local development.

The Evolution of Innovation and the Role of Institutions

This section will describe in more detail the role of institutions in influencing the source, rate, and direction of innovation. Local searching creates local institutions. Institutions are different in each area and are innovative products themselves, created out of a need (at least felt once upon a time) to organize resources

Table 2. Specific Assets in Different Production Regions

Production Region	Specific Assets
Mexico	Very low relative labor costs Extended shelf life varieties Winter growing climate Close proximity to southern U.S. markets Favorable exchange rates
Canada	Greenhouse technology Close proximity to northern U.S. markets Favorable exchange rates
Florida	Winter growing climate Industry size and large vegetable sector Proximity to eastern U.S. markets
California	Industry size and large vegetable sector Proximity to western U.S. markets

to pursue markets, develop technology, share information, lobby for market power, and protect markets.

Institutions are factors of production that influence relative productivity. Institutional structures such as government procurement programs, legal protection for intellectual property, and cooperative and nonprofit research arrangements can create a unique local setting to mobilize capital and labor (Wright). There is also the matter of collective learning. Gavin Wright further points out in his article that technological change is basically learning and that learning, especially in the context of regional producer groups, is a network phenomenon.

Many kinds of institutions exist that support development in each of the tomato production regions. Government entities that facilitate research and extension efforts, as well as local rules of business exist alongside basic research institutions, producer groups, agribusiness groups, and trade organizations. In many cases, the institutions are formed to create some sort of collective good. The institutions, however, often develop regionally and direct varying amounts of resources to solve

Table 3. Institutions Providing Research and Producer Support

Production Region	Producer Institutions	Major Research Institutions
Mexico	Confederation of Ag Associations of the State of Sinaloa; Fresh Produce Associations of the Americas	Volcani Institute
Canada	Ontario Greenhouse Vegetable Producers Marketing Board	Harrow Research Centre
Florida	Florida Tomato Commission	University of Florida
California	California Tomato Commission	U.C. land grant and state schools

local problems felt by the immediate constituents of those institutions.

The Harrow Research Centre in Canada, for example, directs considerable effort in solving greenhouse production problems. Discussions with producers from the Florida Tomato Commission reveal a keen interest in, and financial support for, labor-saving technologies for field tomatoes, a problem hardly on the horizon for producers in Mexico, where labor costs are low, or in Canada, where the production system is different. In Mexico, the focus has been on developing the advantages derived from the extended shelf life varieties. The plant varieties, developed at the Israeli Volcani Institute, were readily adaptable to the

conditions in Mexico, but less so in Florida.⁶ The institutions are different, as noted in Table 3, and have been charged to address different problems quite unique to the factors employed in the region, as noted in Table 4.⁷

Alliances are institutions, as well. Certain kinds of alliances emerged over time that led to sharing or transfer of technology between producers in the United States and Mexico (Sparling and Cook). Some of the technology has been developed by specific agribusiness concerns. The role of the large multinational, research-oriented agribusiness is complicated in the regional cluster development framework presented here. Let it be sufficient to note that even these developments, such as vegetable biotechnology and germ plasm, are not easily transferred across regional production systems. The agribusiness contributing the innovation, like the academic or government research institution, is also drawn into the regionally defined trajectory of problem solving. There is an iterative searching for oppor-

Table 4. Problem Sets Focused On for Innovation

Production Region	Primary Problem Sets
Mexico	Extended shelf life varieties Water scarcity
Canada	Improving greenhouse production technology Premium pack product development (e.g., cluster tomatoes)
Florida	Labor cost-reducing technologies Field and packinghouse technological improvements
California	Variety improvements, especially for color

Sources: Sparling and Cook, Plunkett (Mexico); Harrow Research Centre (Canada); California Tomato Commission, Beckman (California); Florida Tomato Commission, DiMare (Florida).

⁶ See D. Plunkett for an extended discussion of producer groups and technological developments in Mexico.

⁷ A very detailed history of technological development in the Dutch greenhouse industry is presented by J.S. Buurma. Buurma traces distinct development periods since 1945 of reconstruction, mechanization, computerization, and integration. The story in the Netherlands is similar: technological change was driven by observed changes in demand in the auction markets and international trade and was pursued by producers through local research institutions. An interesting point in this case is that the evolution for greenhouse vegetables tracked very closely with the expansion of the cut flower industry.

tunity by agribusiness concerns. Not all production regions are regarded with equal interest as new technologies are rolled out.

Institutions are designed to further the objectives of their creators. Entrepreneurs seeking economic and/or political advantage create institutions to maximize their wealth-maximizing positions (North). The point here is that the actors creating these regional institutions are, in most cases, different actors and are designing and directing institutions with somewhat different ends in mind. Institutions might be created as a countervailing measure against observed moves by rival production areas, but they still largely serve a local purpose. Institutions are local and evolve along a path determined by local challenges and opportunities. Institutions, however, can vary widely in their capacity and effectiveness to help a local industry develop.

Conclusions

Trade economists and some of our neoclassical traditions focus on states of market and resource equilibrium. Competitive advantage in many cases is regional and is developed through local, limited searching for solutions to challenges and pursuit of opportunity. Although somewhat like products can show up in the same market from different regions, the resources or assets combined to deliver those products can be quite different; therefore, simple comparisons of annual prices or costs can overlook significant aspects of the bigger picture. The sources, rate, and direction of technological change and, therefore, competitive advantage need to be considered in the discussions of fair trading and economic development. Competitive advantage and regional industry development are highly dynamic concepts, as illustrated in the case of fresh tomatoes. Price thresholds determined in certain trade agreements might turn out to be short-lived in their appropriateness as gauges for fair trade as competitive advantage changes quickly between regions.

Simple comparisons of cost of production differences look too narrowly at the dynamics of competition and advantage. Economists

need to discover a way to bring the full range of assets into the fair trade discussion. Competitiveness and the production function needs to be defined by more than just physical factors of production as part of a universal production function

Institutions play a substantial role in the discussion because they often are the sources for technological change and influence the rate and direction of change. When well designed, institutions can contribute substantially to local economic performance. Institutions are a big part of the mix of assets that a region can draw on to create and sustain advantages. These can include grower groups, governments, and trade associations, but there also is a critical factor of related and supporting businesses to support a whole production and distribution chain.

References

- Beckman, E. Personal Communication. California Tomato Commission, January 2003.
- Brown, S.L., and K.M. Eisenhardt. *Competing on the Edge: Strategy as Structured Chaos*. Boston, MA: Harvard Business School Press, 1998.
- Buurma, J.S. *Dutch Agricultural Development and Its Importance to China, Case Study: The Evolution of Dutch Greenhouse Horticulture*, Report 6.01.11. The Hague, Netherlands: Agricultural Economics Research Institute, October 2001.
- DiMare, P. Personal Communication. The DiMare Companies and Florida Tomato Commission, October 2002.
- Federal Register*. "Suspension of Antidumping Investigation: Fresh Tomatoes From Mexico: December 4, 2002 Agreement," A-201-820, Investigation Public Document, G103:MHR, 2002.
- Harrow Research Centre. *Greenhouse and Processing Crops*. Internet Site: http://res2.agr.ca/harrow/index_e.htm (Accessed April 14, 2003).
- McLaughlin, E.W., and K. Park. *The Fresh Produce Wholesaling System: Trends, Challenges, and Opportunities*. Research Bulletin 97-16. Ithaca, NY: Cornell University and Produce Marketing Association, 1997.
- North, D.C. *Institutions, Institutional Change and Economic Performance*. Cambridge, UK: Cambridge University Press, 1990.
- Plunkett, D.J. *Mexican Tomatoes—Fruit of New*

- Technology. Vegetables and Specialties Situation and Outlook*, VGS No. 268, ERS, USDA, April 1996.
- Porter, M. *The Competitive Advantage of Nations*. New York: The Free Press, 1990.
- Ruttan, V.W. "Induced Innovation and Path Dependence: A Reassessment with Respect to Agricultural Development and the Environment." *Technological Forecasting and Social Change* 53:41-59, 1996.
- . "Induced Innovation, Evolutionary Theory and Path Dependence: Source of Technical Change." *The Economic Journal* 107(444): 1520-29, 1997.
- Sparling, D, and R. Cook. "Strategic Alliances and Joint Ventures Under NAFTA: Concepts and Evidence." Paper presented at the Fifth Canada/Mexico/US Conference on Policy Harmonization and Adjustment in the North American Agricultural and Food Industry, Acapulco, Mexico, March 1999.
- Thompson, G.D., and P.N. Wilson. "The Organizational Structure of the North American Fresh Tomato Market: Implications for Seasonal Trade Disputes." *Agribusiness* 13(5):533-47, 1997.
- USDA-AMS. *Vegetable Shipments by Commodities, Origins, and Months*. Washington, D.C., 2001.
- Wright, G. "Towards a More Historical Approach to Technological Change." *The Economic Journal* 107(September):1560-66, 1997.