Rural Innovation – Crucial, But Rarely Systemic
November 25, 2012
Version 1.2

Why Rural Innovation Is Different

While innovation is now often seen as an urban phenomenon (Berry, 2005; Florida, 2003; Fratesi and Senn 2009; Johnson, 2008; Wolfe, 2009), the urbanization of society essentially only occurred because of innovation that took place in rural areas. The growth of cities would have been greatly limited without the improvements in agriculture that allowed an ever smaller share of the population to steadily increase agricultural output. More recently, in the OECD countries the decoupling of economic growth from natural resource constraints also reflects significant technological advances in all forms of natural resource production that allow households and firms to now spend only a small share of their budgets for food, energy, and raw materials.

Our understanding of the innovation process has recently evolved from a focus on individuals (for example, Watt, Edison, Ford) who somewhat serendipitously come up with novel ways to solve problems that affect their life or work, or persons who happen upon an idea for a new product, process or market. This version of the innovation process focuses on the individual as inventor. From this perspective innovation is an exogenous shock to the economic system, perhaps best depicted in Schumpeter's process of creative destruction (Schumpeter, 1983). By contrast, current thinking about innovation focuses on innovation systems (Asheim, Lawton Smith and Oughton, 2011; Cooke and Morgan, 1998; Moulaert and Sekia, 2002). From this newer perspective innovation becomes an output that can be achieved by systematically applying human effort and existing technology to create new products or processes that satisfy some pre-specified need. While the knowledge generation process may not be successful all the time, it is believed that the odds of success increase with the level of effort applied.

This leads to innovation being a key part of an endogenous growth process. Thus, in the standard Romer growth model, investments in formal research and development activities lead to innovations that increase productivity and generate economic growth. The circle is completed by diverting some of the returns from economic growth back into further investments in R&D that produce the next round of innovation. One important reason for the interest of economists in innovation systems is that they provide a useful mechanism for eliminating the awkward reliance on exogenous technological change that plagued earlier growth models.

Innovation systems are more likely to be found in larger urbanized regions (Fratesi and Senn, pp. 10-12) at least in part because they involve large scale commitments of highly skilled researchers and specialized research facilities and equipment. This makes them the purview of large universities, corporate research centers and government laboratories. Certainly, a large portion of the innovation in natural

resource production now takes place in this type of environment. For example, Monsanto develops its herbicides and herbicide resistant seed varieties in it's corporate laboratories in St. Louis and in conjunction with major universities with specialized agronomy and plant science faculty. In this situation innovation originates in urban regions, but with the explicit intent that the results will ultimately be implemented in rural regions.

Yet, even in farming, where the contribution of large scale innovation systems research is clearly important, other forms of innovation continue to play an important role. Not only did a large amount of agricultural innovation take place before formal agricultural research programs were implemented in the late 1800s, but there are still agricultural innovations with origins outside the formal, science-based R&D systems approach. Drip irrigation systems were developed on Israeli kibbutz farms in the 1960s. Modern four wheel drive tractors were first introduced by the Steiger brothers at their Thief River Falls, Minnesota farm in 1957.

Agriculture remains the quintessential rural industry, however it is not unique in being innovative. Technological change has been equally rapid in forestry, both in terms of forest management practices and timber harvesting equipment. Similarly rapid advances in fishing technology complicate efforts to regulate the fishery, and the rapid growth of aquaculture represents a completely new industry. Mining and energy production have steadily increased the economically exploitable resource stock, even as large quantities of a finite resource are consumed. In all these industries the result has been a falling number of workers and massive capital deepening that have increased labor productivity.

While the most common measure of innovation is patent activity, this is a measure that is biased to formal innovation systems. Indeed the objective of most formal R&D innovation systems is the generation of a patent as the vital first step preceding the introduction of an actual innovation. The patent provides the mechanism that generates the future income to keep the R&D process in motion. Especially for corporate laboratories, and increasingly for university laboratories, the possibility of a patent with a high market value has become an important driver of specific research efforts. This leads to formal research systems following a biased investment approach that favors large market, high potential payback endeavors.

Dabson notes that while the US has recently promoted place-based policy that focuses on innovation, the idea of rural innovation systems remains an under-explored topic (Dabson, 2011). He says this reflects a policy belief that cluster-based innovation is unlikely in rural regions (pp. 11-12). In response Dabson suggests five propositions for stimulating rural innovation at the region level (pp. 17-18). The essence of his principles is that firms in rural regions can identify sectors where space and low density are advantages, and find ways to collaborate across distance. Innovation and entrepreneurship are seen as central to rural development, as are collaboration among firms and forging stronger rural-urban linkages. Once again, the idea of an individual inventor/innovator is replaced by an innovation systems

approach that sees innovation flowing from the interaction of a critical mass of firms – the cluster, even though firms need not be spatially contiguous.

Evidence exists showing that many rural firms already innovate, but that they largely innovate outside the formal R&D process (Moseley, 2000; Verkkala, 2007). Because most firms in rural regions are small and medium size enterprises, they rarely have formal internal R&D activities. And, while some rural firms do file patents they are less likely to follow this path for several reasons. The first is that their innovation may not be patentable. The second is that the cost of filing a patent and then enforcing it may be beyond their financial capacity. A third reason is that the innovation may be seen by the firm as having such a small and specialized market that there is little fear of competition.

In reality other strategies may provide as much, or more, protection to the innovator as a patent. Trade secrets, trademarks, and linking the product to high quality customer service can all provide forms of protection that limit competition. For a small firm they may be more effective strategies. However, if only patents are used to measure innovation, then only patented innovations will be counted which has led to the emphasis on urban areas as the source of innovation. The emphasis on patent statistics also overstates the value of the innovations they describe. Large numbers of patents are never acted upon, so no benefit to society comes from the research efforts that produced them.

This suggests that identifying a broader definition of innovation is the starting point when examining innovation in rural areas. Baumol provides a clear synopsis of Schumpeter's ideas on the links between innovation and entrepreneurship that is useful for defining this broader perspective on innovation. (Baumol, 1990). In part II of the article Baumol demonstrates that Schumpeter is clear that innovation takes a number of forms beyond improvements in technology. Five specific forms of innovation are identified:

1. The introduction of a new good or significant improvements in the quality of a good
2. The introduction of new method of production, but which need not involve a new technology
3. The opening of a new market
4. Developing a new source of supply of inputs
5. Changes in the structure of the market in ways that either increase monopoly power or reduce monopoly power.

Baumol, 1990 pp. 896-897

An important implication of this approach to innovation for the economic growth of rural regions is that the growth and innovation process need not be endogenous. Unlike in the Romer endogenous growth model, there is no causal feedback loop from innovation to growth and back to innovation that results in self-sustaining growth. Innovation is in some sense serendipitous and depends upon the actions of

individuals. However, this approach to innovation is consistent with the rest of the rural economy, where the actions of individual firms and individual community leaders can have a great bearing on outcomes. Because rural economies are open, small, specialized and truncated, they are highly exposed to shocks from the rest of the world. The success or failure of a single firm can have a major impact on the evolution of a rural region, because that specific firm plays a large role in the local economy.

Exemplars of Rural Innovation

Because rural innovations are primarily driven by individual entrepreneurial actions they mainly benefit the individual firm that originates them. If this firm remains an SME the spillover benefits to society from the innovation will be small and restricted to the customers of the firm who experience a better product or service or a lower price. Certainly there may be some modest benefit to the region if the firm remains viable or expands slightly as a result of its innovation. But, in general, rural innovation conveys few large social benefits of the type identified with formal innovation systems.

However we can identify a number of rural firms that grew over time to a point that they are now widely recognized global companies. Although some of these companies have left the rural community that was their origin, they have in common two things. The first is they were the idea of one or two individuals who created the firm and led it through at least its early growth. Second, the entrepreneur established the firm in a small rural community. Some of these firms have relied upon patents to protect their innovation, but others have not.

Wal-Mart

Wal-Mart is the largest retailer in the world with stores in both developed and developing countries. It is widely credited with having revolutionized the logistical process for managing inventory and this continues to give it a crucial advantage over its competitors in cost control. Wal-Mart was started by Sam Walton in Bentonville Arkansas in 1950. At the time the population of Bentonville was 2,900 people and Bentonville remains the corporate head office for Wal-Mart. Bentonville now has about 35,000 people largely because of Wal-Mart's presence. Wal-Mart's main innovation did not involve a patent or a trade secret, but rather the creation of a sophisticated logistics system that lowered its costs. This system continues to give it an advantage, even though competitors emulate it, because of its scale and tight integration into the firms entire operations.

Bombardier

Bombardier is the third largest global producer of commercial aircraft and one of the leading manufacturers of rail equipment. Bombardier was started in 1942 by Joseph-Armand Bombardier in Valcourt, Quebec to manufacture tracked snow machines. Bombardier filed the first patents for the drive technology, which gave the firm an initial advantage. In the 1960s Bombardier popularized recreational

snowmobiles and later jet-skis, allowing the company to grow rapidly. Other manufacturers developed similar technology but Bombardier continued to innovate through style and new features. In the 1970s the Bombardier family began to purchase a number of failing aircraft and rail manufacturers that soon became the main activity of the company. The corporate head office was moved to Montreal after the company went public. In 2003 the snowmobile, jet ski and motorcycle division was spun off as Bombardier Recreational Products. (BRP). A controlling interest was bought by the Bombardier family who returned the BRP corporate office to Valcourt, which has a population of under 2,500 people.

LEGO

LEGO is the fourth largest manufacturer of toys in the world. It began in 1916 in a wood working shop operated by Ole Kirk Christensen in the village of Billund, Denmark. Christensen started making furniture but during the Depression switched to making wooden toys. In 1937 the firm purchased a plastic injection machine and began making plastic blocks that became the success of the company. Lego patented the basic design of its blocks, but the patent is not a major impediment to competitors. Instead LEGO relies upon continuously introducing new designs that lead to new sales. Descendants of the founder continue to run the company from its Billund headquarters.

Rip Curl

Rip Curl makes wet suits for surfers and is a leading company in its market segment. It was founded in Torquay, Australia in 1969 by Doug Warbrick and Brian Singer. Initially the firm made surfboards but within a year refocused on wet suits because there was less local competition. Rip Curl succeeded not through patents but by producing wet suits that continuously evolved to provide better products for their target customers. The firm now produces a complete line of surfwear clothing and accessories in addition to wetsuits. Rip Curl licenses its designs and techniques to firms outside Australia that serve specific markets. The firm remains in headquartered in Torquay.

Quiksilver

Quiksilver was also founded in Torquay Australia in 1969 by Alan Green, who at the time was an employee at Rip Curl. Green's initial focus was on surfing shorts and by 1970 he was successfully selling board shorts in Australia. By the end of the decade the firm was exporting its surfware to multiple countries and had established licensed production around the world. In 1976 Quiksilver USA was founded in Huntington Beach, California, and in 1986 the US company went public. Over time the US operation gradually absorbed the other licensees and the Australian originating firm. Trademarks are important to Quiksilver including its logo and various pattern designs. In the 1990s the company expanded into clothing for skiing and snowboarding as well as wetsuits. In the late 1990s it expanded into

skateboarding with boards and clothing to make it the world's leading board sport clothing company.

KFC

Kentucky Fried Chicken has its origins as a supplemental business found by Harland Sanders in Corbin Kentucky in 1930. It began as a restaurant associated with a gasoline station, but the fried chicken became a global success. KFC is the largest chain of fried chicken restaurants in the world and is now part of YUM Brands, the second largest global fast food chain. The KFC chicken recipe remains a trade secret and the growth of the company can be traced to the taste of the chicken and a highly successful marketing strategy including some of the first use of franchising introduced in the 1950s by Sanders.

These six examples of global companies, two of which originated in the same small town of Torquay in 1969, illustrate several key points. The first is that disruptive innovations can come from small places. Christenson (1997) defines a disruptive innovation as one that fundamentally alters the market for a good or service in a way that leaves incumbent firms that previously dominated the market struggling. The new firm often does not provide a major technological breakthrough, but instead innovates in a way that restructures the market place. Of the six firms described above only Bombardier relied upon significant technology patents. The rest relied upon better designs, better business management and identifying new market segments. Second, these firms all grew slowly at first in relative isolation from direct competitors while they perfected their business plan. This points out a potentially significant advantage of rural innovation. Third, the firms originated from one or two entrepreneurs who had a fundamental knowledge of the industry sector in which the firm entered. These firms developed a single activity for which there was a clear local demand and then leveraged their expertise to expand. Finally, these innovations all took place outside the context of a "learning region". Collaboration among firms within a cluster, access to university research and government support were not factors in any of these situations.

Obviously, these are specific examples drawn from the larger context of rural innovation. But they are far from isolated cases. With little effort it is possible to find other examples of disruptive rural innovations where innovations are understood in Schumpeter's sense. From a regional development perspective innovations at this level can still make a major difference to the local economy, even though the vast majority of the activity of these global firms occurs elsewhere.

This larger global effect is ultimately the main difference between a normal rural innovation and a disruptive one. Only the disruptive innovation has the large global effects that draw national and international attention. But, these effects are mainly experienced outside the region of origin. In terms of the purely region specific effects on local development, it is conceivable that a normal rural innovation that leads to modest expansion of a specific SME has similar impact to the local effect of a disruptive firm. For it is only after a considerable period of time when the majority

of the activity of the disruptive firm has moved to other regions that it becomes clear that it actually is disruptive.

Rural Regions and Innovation

As was noted earlier, rural regions are largely unsuited for innovation based on formal large scale science based innovation. They obviously lack the basic inputs for this approach – research universities, a high share of the labor force with advanced degrees, corporate headquarters and major government installations. Moreover, rural regions are under-represented in the industries where innovation systems have had the greatest success – computers and software, mobile phone technology, bio-chemistry, medical devices, advanced defense products and aerospace. These are industries where production processes are highly capital intensive and workforces require advanced skills. They are also industries that rely upon a host of specialized support firms that can only exist in a large urban center. For many of these industries there is a global market and locations lacking a major international airport are unacceptable.

These shortcomings, although they only relate to the viability of formal innovation systems, have been interpreted as making innovation improbable in rural regions. In many rural regions the result has been an absence of innovation, perhaps because potential entrepreneurs lacked the confidence to act upon their innovative idea. Yet innovation may be more important for rural regions than for large cities or large urbanized regions. Rural regions are much more specialized in the production of tradables than are urban regions. While remoteness may protect some high cost rural regions from import competition, high transport costs make it harder for the same industries to reach external markets. Moreover, transport costs in the OECD countries are steadily declining over time so more rural firms are now exposed to at least contingent competition.

This means that productivity improvements are imperative. Supposing there are no diseconomies of scale, then increasing output is always advantageous for the firm because at a minimum it allows fixed costs to be spread over a larger base, and it may result in falling variable costs. For rural firms facing a small home market the only possibility of increasing production is to increase external sales. But, to increase external sales rural firms must be able to at least match the delivered cost of firms that are geographically closer to the intended market. Productivity increase thus become the necessary first step for increased rural exports. And, in rural regions the small size of the economy means that the viability of individual firms has a direct impact on the economic well-being of the region. If a firm that plays a key role in generating income from external sales either fails or expands, not only are the direct income and employment effects potentially large, but so too are the indirect effects on the remainder of the regional economy.

By contrast, in urban areas, not only is there a smaller share of tradables in total production, but the large home market reduces the importance of transport costs as a factor in total costs. Consequently, urban firms that do not face stiff local

competition may be under less pressure to increase productivity, simply because transport costs provide a large enough barrier to external competitors. Indeed, there is a body of thought that competition is not a useful concept for understanding the behavior of nations or large regions because the fate of individual firms is generally immaterial to the aggregate economy (Krugman, 1996).

Conclusion

Innovation in rural areas tends to be driven by individual entrepreneurs. Indeed most definition of entrepreneurial behavior tend to emphasize the importance of innovation. An entrepreneur creates a new product, process or technology that has commercial value. It is the coexistence of creation and commercial value that defines an innovation. According to Schumpeter the value of entrepreneurs is the disruptive effect they have on existing firms. For rural regions entrepreneurial activity offers perhaps the best chance to stimulate economic growth. Moreover, most firms in rural regions are SMEs and unlikely to participate in formal innovation systems activity. This too suggests that individuals will be the main source of innovative ideas.

Most rural regions remain reliant on a small number of export oriented industries that bring in external income that is used to buy all the items the region does not produce itself. Rural regions have specialized, truncated economies that are oriented to producing low unit value products largely because rural regions have small home markets, small local labor supplies and the workforce has a limited set of skills. The items exported by any rural region tend to face competition from other rural regions in OECD countries and from developing nations. This makes the competitive position of the region highly sensitive to its relative cost of production.

Two possible approaches to this situation exist and both involve innovation. The first form of innovation is to find ways to lower production costs to increase the competitive position of a firm. The second form of innovation is to find ways to differentiate the output of the firms in a region so that their products command higher prices. While the motivating force for both approaches is to increase the profitability of individual firms the region directly benefits from increased profits through higher income and potentially through increased employment.

However, in many rural regions, while innovation may drive firm productivity and profitability, the implications for increased employment are less clear. Two aspects of rural regions condition the employment implications of innovation. The first is that evidence suggests that existing firms in rural regions typically have low productivity, which makes them susceptible to entry. In many cases this low productivity can reflect an inability to reach minimum efficient scale because existing markets are too small. In other cases it reflects weak management and a lack of competition. Either way, if innovation comes in the form of an entrepreneur who sees an opportunity to displace an existing firm that has low productivity, the innovative firm will also displace the exiting firm's labor force with its own. And, if

its advantage comes from an innovation that increases productivity then the net effect may be a reduction in employment, *ceteris paribus*.

In the second case an existing firm may innovate in order to improve its competitive position. But, once again, the innovation if it increases productivity without increasing output will lead to falling employment. Gardiner, Martin and Tyler (2004) note that regions in the Central and East European states experienced significant increases in productivity between 1993 and 2001 (p.17), but employment in high productivity regions tended to decrease (p.27). This suggests that in rural regions the effect of increased productivity may be a substitution of capital for labor, which improves the viability of the firm, but which decreases employment.

In the past there was a focus in rural regions of the OECD on increasing employment because of surplus labor, in particular a surplus of low skill labor. A likely consequence of this approach was the introduction of relatively low productivity firms, since they were most amenable to employing large numbers of low-skill workers. Moving forward, rural regions will be more likely to see labor shortfalls due to an aging and shrinking workforce. Thus, while productivity increases, which lead to employment reductions, would have created a policy dilemma in the past, they are more likely to be viewed as a positive effect in the future.

References

Asheim, B., H. Lawton Smith and C. Oughton. 2011. Regional innovation Systems: Theory, Empirics and Policy. *Regional Studies*. 45:7 pp. 875-891.

Baumol, William. 1990. Entrepreneurship: Productive, Unproductive and Destructive. *Journal of Political Economy* 98:5 pp. 893-921

Berry, M. 2005. Melbourne – Is Their Life After Florida? *Urban Policy and Research* 23:4 pp. 381-392

Christenson, Clayton. 2000. *The Innovator's Dilemma*. HarperBusiness: NY.

Cooke, P and K. Morgan. 1998. *The Associative Region*. Oxford University Press: Oxford.

Dabson, Brian. 2011. Rural Regional Innovation: A Response to Metropolitan-Framed Place-Based Thinking in The United States. *Australasian Journal of Regional Studies.* 17:1, pp. 7- 21.

Florida, R. 2003. Cities and the Creative Class. *City and Community* 2:1 pp. 3-19

Fratesi, Ugo and Lanfranco Senn. 2009. Regional Growth, Connections and Economic Modelling: An Introduction. in Fratesi, U and L. Senn eds. *Growth and Innovation of Competitive Regions* Spinger-Verlag: Heidelberg.

Gardiner, Ben, Ron Martin, and Peter Tyler. 2004 "**Competitiveness, Productivity and Economic Growth across the European Regions**," ERSA conference papers ersa04p333, European Regional Science Association. available : http://ideas.repec.org/p/wiw/wiwrsa/ersa04p333.html

Johnson, B. 2008. Cities, Systems of Innovation and Economic Development. *Innovation: Management, Policy and Practice* 10: 2-3, pp146-153

Krugman, Paul. 1996. Making Sense of the Competitiveness Debate. *Oxford Review of Economic Policy.* 12 pp. 17-35.

Moseley, Malcolm. 2000. Innovation and Rural Development: Some Lessons from Britain and Eustern Europe. *Planning Practice and Research*, 15:1/2, pp. 95-115.

Moulaaert, F. and F. Sekia. 2002. Territorial Innovation Models: A Critical Survey. *Regional Studies* 37:3 pp. 289-302.

Schumpeter, Joseph. 1983. *The Theory of Economic Development*. (translated by Redvers Opie). Transaction Publishers: New Brunswick, NJ.

Verkkala, Seija. 2007. Innovation and Networking in Peripheral Areas – Emergence and Change in Rural Manufacturing. *European Planning Studies* 15:4 pp. 511-529.

Wolfe, D. 2009. 21st Century Cities in Canada: The Geography of Innovation. 2009 CIBC Scholar–in-Residence Lecture, Conference Board of Canada: Ottawa. available: http://www.nlreda.ca/system/filestore/Reports/External/21stCenturyCitiesinCanada_2009_web.pdf