

Rural and Small Community Technology Clusters: Back to the Basics

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Throughout the United States, disadvantaged, declining and struggling rural and smaller communities have wrestled with the problem of developing a sustainable base for economic activity.

In North Carolina, for example, although statewide unemployment for the end of 2004 is a very respectable 4.8%, many rural counties are over 7.0%. And in general, economic growth in smaller communities under 50,000 residents lags well behind the larger, more urban such as Raleigh and Charlotte. The same picture is painted in almost every state.

The questions usually asked by community leaders appear ominously similar. How can we attract industry to our community? What can we do to stem the tide of unemployment? What is the role of entrepreneurial activity in rural economic growth? And what about high technology, the intellectual engine of the nation's economic future – can't rural or smaller communities get even a small slice of the new industrial pie?

To some extent, we can answer these questions a little better now – but the true success stories are still rare. Most rural regions, in fact, continue to lose their traditional industries. And in spite of the best efforts of local economic development agencies armed with an arsenal of subsidized incentives, tax breaks, and cash payments, the refurbished factory shells and newly minted incubators remain mostly empty.

So what went wrong? – probably many things. But most importantly, government policy makers haven't paid close enough

attention to the important customers in the economic development game. What exactly does high technology look for in a region? What encourages home-grown start-up innovative activity and do some types of entrepreneurs add more value than others to economic development?

Early regional economic development thought was built mostly upon the intellectual foundation of sociology, education, and government policy research.

More recently, economic and strategy researchers such as Michael Porter¹ of the Harvard Business School have attacked the cluster issue by looking at industry structures and supplier-buyer relationships.

Certainly this work has provided valuable insights, but economic structures, labor indices, and cluster maps can only tell part of the story, albeit an important one.

More can be added to the storyline, however. Developing a sustainable economic development strategy around the idea of rural and small community technology clusters requires returning to the basics. We need to reexamine more closely the opinions of technology-based entrepreneurs, venture capitalists, and corporate managers. These are the real drivers of economic growth and success.

Three Generations of Technology Clusters

The business of technology is an evolutionary process, and the role of modern technology clusters and economic development must be placed within this historical context. It is commonly accepted that the age of modern high technology really

¹ See Porter, *On Competition* (Harvard Business Review Books, MA), 1998.

started in the early-1960s, with the broad commercialization of the integrated circuit by Texas Instruments, Fairchild and others. The integrated circuit then became the platform for hundreds of innovative products. New industries, such as digital watches, electronic calculators, industrial robotics, solid state audio-visual components, and mini-computers were literally born over night.

These new industries needed money, lots of money, and they needed the nearby intellectual power of world class scientists and engineers. Thus was born the first generation of technology clusters in California's Silicon Valley, Rte. 128 of Boston, and the Research Triangle of North Carolina.

By the early 1980s, however, a new generation of technology clusters started to arise. With the exception of the new biotechnology fields, most technology was starting to mature, with innovations improving upon older platforms while spinning out new applications.

As financial, legal, and informational mechanism became more sophisticated, both knowledge and capital became more portable. No longer did high technology firms need to cluster around world class universities or banking centers. Dozens of new technology centers soon emerged, in San Diego and Irvine in California, in the Northwest cities of Portland and Seattle, in the mountains of Boulder, Colorado and the southern plains of Atlanta, Georgia.

Studies of these second generation technology centers suggest that they shared some common characteristics. Large public universities were providing an increasing number of entry and mid-level engineers and technical workers. The centers were located in growing urban areas, with progressive governments, and sophisticated social and economic infrastructures. And perhaps most importantly, they were in remarkably attractive places to live. Thus it was easy to recruit the best and brightest people from other parts of the country. Quality of life became the dominant key to fueling economic growth.

Yet just below the surface strong coalescing economic forces were also at work. These second generation clusters started to become more focused, specializing in certain types of technologies. Beaverton, Oregon became known for its parallel processing capabilities, while biotechnology flourished in San Diego. Medical technology clustered in Minneapolis, and information technology grew in Seattle. And around these primary industries, supporting economic activities soon developed, providing a whole range of material, labor, education, and service inputs. Gradually these second generation technology clusters became tightly-knit networks of interrelated industries, an advantage that many of these regions have to this very day.

By the 1990s, dozens of small clusters of high technology firms emerged in mid-sized urban areas across the United States. Generally these third generation technology clusters were driven by two or three successful entrepreneurs that had strong ties to a particular community.

While not large by traditional standards, the firms that anchor a third generation technology cluster can have significant impact upon the community. For example the growth of PPD, Inc. and Applied Analytical Industries in Wilmington, North Carolina has created a small, but potent pharmaceutical development and testing cluster. Wilmington now ranks in the top 100 areas in the U.S. in pharmaceutical related patents.

Rural and Small Community Technology Clusters: The Fourth Generation

Just as technology continues to evolve, so do the mechanisms by which technology is generated and delivered. Several forces are currently at work which is likely to create opportunities for rural and small communities to participate in technology-driven economic growth. Intellectual property is now remarkably searchable and portable, allowing even the most remote entrepreneur immediate access. High

technology manufacturing is becoming more flexible, automated and modular, creating the potential for much smaller scale manufacturing centers. Rapid communication networks allow for more specialization and greater decoupling of R&D, design, engineering, assembly and sales of high technology products and services. The location of service and call centers are essentially transparent. Distance learning has matured. And finally, there appears to be a growing personal disenchantment with the lifestyles offered by the traditional, large industrial and economic centers.

All of these trends point to the evolution of the fourth generation of technology centers, the rural and small community technology cluster. And while globalization has reduced the economic need for traditional industrial clusters at the regional level, the economics of many technology based industries are still based upon local social capital, local networks of knowledge and local “just-in-time” expertise that distant competitors simply can not match.

What is a rural and small community technology cluster? While there is no firm agreement about the definition of clusters, *Regional Technology Strategies*, located in North Carolina has identified some underlying characteristics². Clusters are based on systemic relationships among firms, they are geographically bound, and they have life cycles. And they tend to be constructed around concentrations of specific industry sectors.

For the purposes of this article, by small communities, we mean cities less than 50,000 residents to include even small towns in rural counties. As such, rural and small community technology clusters will naturally be much smaller in scale, but hold to the same underlying characteristics as any cluster. In addition, a rural and small community technology cluster may act as a

feeder cluster to a larger, more established urban cluster.

There is an expanding literature that examines economic clustering. And within this literature there are many solid and useful recommendations to enhance a clustering strategy. The purpose of the article, however, is not to rehash prior analysis or recommendations, but rather to examine some important areas of regional technology clusters that have been largely ignored in the prior literature.

Can We Learn from Europe?

Europe is fascinated with the concept of technology clusters. In fact, clusters have become the cornerstone of the European Union’s effort to reinvigorate their struggling economies. Their concern is understandable. EU unemployment is almost double that in the US and Japan. Traditional powerhouses such as Spain and Germany now report sluggish economic growth and unemployment over 10% percent. In Poland and Slovakia unemployment appears stuck around 17%.

Technological development in Europe lags well behind the U.S. in almost every measure of innovation and scientific discovery. And the new economies of China, India, and Brazil are taking business away from EU countries at an alarming rate.

According to almost every report by the European Commission, the future European economy needs to be built around the concept of clusters, or geographically bound interrelated networks of firms and labor. This interest in clusters, particularly those that are technology based, is partly due to the well documented success in the late 1980s of industrial clusters in Italy. Yet in spite of the billions of dollars spent by the EU to encourage and support technology based clusters, the success stories remain somewhat elusive. Why?

The answer, we believe, was found at a 2004 business incubation conference held in Bremen, Germany. Attended by top representatives from around Europe, the first

² *Creating Sound Systems: A Guide to Cluster Strategies in Less Favoured Regions* (Regional Technology Strategies, NC), 2002

day focused on the typical myriad of governmental incentives and the required “measures, schemes, actions, and regulations” that European officials find so attractive.

The first speaker was a senior regional development officer from a large European country. He passionately presented the required twenty-five steps each entrepreneur needed to follow in order to get even the smallest incentive grant, the ten governmental offices that provided continuous oversight, the weekly paper work that needed to be filled out to measure progress, and required government consultancy that was to formally guide the firm’s growth. The next speaker, not to be outdone, proudly discussed an even more complex and expensive process.

Afterwards two young and very nervous entrepreneurs were introduced. Marched to the front of the conference hall they were presented, almost like captured prisoners, as examples of the European process of technology based enterprise incubation and cluster design. Sadly, neither of the two entrepreneurs had made a profit in two years of operation.

The lesson became painfully obvious. These entrepreneurs were like young children struggling to take their first uncertain steps. But surrounding them was a bureaucratic horde of well-meaning family members, each one hovering, shouting, disagreeing, prodding, measuring, and overall distressing the situation. No development was taking place, just noise.

Technology economic development in rural and small communities is, indeed, perhaps a little like early child development. But like child development, complexity, confusion and expensive toys are not necessarily the best approaches. Perhaps a better design is more a process of back-to-the basics guidance, simple and correctly constructed incentives, and letting the entrepreneurial “child” discover his or her strengths.

Can the U.S. learn anything from the European experience with clusters? Yes, but

mostly from the mistakes of complexity and bureaucracy.

Regions as “Products”

Research has clearly shown that both established high technology firms and newly minted entrepreneurs make rational decisions about where to locate, expand, or start their enterprises. They tend to view a region similar to a product, and just like any product a particular region has tangible attributes. These attributes are things such as its skilled labor force, level of local education, housing stock, and quality of life. And similar to a product on a retailer’s shelf, what that region “sells” to industry is its unique mix of attributes.

If regions are like “products”, then the market for “regions” can be seen as a product space, with multiple dimensions representing these various attributes of skilled labor force, quality of life, etc.

Where a particular region or community is perceived to be within this “product space” will determine what type of technology cluster can actually be developed, or whether or not the region even stands a chance to attract a technology base. After all, technology based activities, whether a subsidiary of a large pharmaceutical firm or a two person entrepreneurial R&D start-up, will have strong regional “purchase preferences” that map onto the same product space. And if the enterprise’s preferences map closely to the perceptions of a particularly community, then a “sale” might take place.

But the market is also highly congested. Competition is intense, with a lot of different regions, communities, states, and even nations seeking to attract the same customer, the technology based enterprise. There are a lot of choices, and simply no room for mistakes.

Rural and small community economic development, entrepreneurial incubation, and industrial cluster design is no longer a causal pastime. It has become a cutthroat and highly aggressive global business. And it

must be approached like any other business – the product needs to be properly designed and sold, or it will most certainly fail. But the good news is that with careful planning and implementation many rural and smaller communities can, in fact, successfully position themselves in the regional market place for technology-based economic activity.

Technology Economic Development 101: Beauty is Good Business

Beauty is good business. In the world of technology based economic development, this can be taken as an absolute article of faith. Quality of life and ambiance has been shown in survey after survey of technology based entrepreneurs and managers as being one, if not the most important factor, in their decision to start-up, relocate, or expand their business³.

A region or community's quality of life is critical for several reasons. First, the best and brightest homegrown entrepreneurs will want to stay in the area rather than moving to another, more attractive, community. Second, it is much easier to attract non-local technical personal such as engineers, scientists, and programmers, to an area. Studies have consistently showed that technically trained personnel rate ambiance and school quality as the most important criteria for their relocation decisions. Third, senior managers are very influential in a firm's decision to locate a plant into a particular area. Even if the facility is a manufacturing site for a high technology firm, the plant management team will

probably be transferred in. But word gets out fast. A nice place to live becomes an instant draw within the corporate world. Plant management will fight to stay, other managers will request to be transferred to attractive communities and in some cases, managers will spin-off new firms just to stay in the area.

The "SGT" Factor

Signage, Graffiti, and Trash. These are the killers for high technology development of any type. Research at the Cameron School of Business at the University of North Carolina Wilmington has shown that communities with a high percentage of computerized digital signs, temporary blinking signs, interior lit can signs, menu boards, bill boards, sign misspellings, banners, and window signs are ranked twenty to forty percent lower in attractiveness for business location by executives.

Sloppy signage creates a perception of "lack of pride" in a community. The worst offenders are the new computerized signs that use the warnings colors of red and yellow. Not only are they devastating to economic development, but eye tracking studies show that they are dangerously distractive for drivers. Sure, business needs signage, but it can be visually attractive and unobtrusive.

Graffiti is another death knell to technology based economic development. Whether committed by actual gangs, young taggers, bored pranksters, or fraternity initiators, even the slightest hint of graffiti creates a negative perception of "safety".

And finally, litter on roads, walkways, and alleys; "trashy" looking store fronts and gas stations; ugly asphalt parking lots without landscaping -- together this creates an image of a community in "decline".

Without question, the SGT factor is the most important economic development tool available to communities, particularly for those trying to develop a technology based cluster. And best of all, it doesn't cost anything. It is a completely free economic

³ For example, Galbraith, "High Technology Location and Development: The Case of Orange County", *California Management Review*, 1985; De Noble and Galbraith "Third Generation Technology Centers: The Relationship Between Business Strategy, Flexible Manufacturing, and High Technology Development" in Lawless and Gomez-Mejia (eds), *Advances in Global High-Technology Management*, Vol. 3 (JAI Press), 1993. Galbraith, Rodriguez, and De Noble, "SME Competitive Strategy and Site Location Behavior: The Case of High Technology Manufacturing," *Journal of Small Business Management*, 2005.

development incentive. Simply pass the appropriate regulations, and then enforce them.

Nationwide, studies have shown that there is a direct correlation between SGT factor and business growth and employment. Communities with strong SGT controls enjoy low unemployment while communities with weak SGT controls suffer from declining economies and high unemployment.

People often wonder why some of the best universities in the U.S., many which graduate highly trained Ph.D.s in science, engineering, and computer sciences have been unable to establish even a small technology cluster within their surrounding communities. Look to the SGT factor as the explanation.

Few entrepreneurs, managers, engineers, or programmers want to live and play in a community that visually screams on every street corner a lack of community pride. The core drivers of economic success will simply move someplace else.

The bottom line? Perception is everything. Albeit perhaps unknowingly, government officials and community planners that ignore the SGT factor are, in fact, anti-economic growth and pro-unemployment.

A Bigger Bang for the Incentive Buck

In 2005 the City of Wilmington, NC approved a multi-million dollar incentive package for the pharmaceutical company, PPD, Inc. Included in this deal was a requirement that PPD, Inc. bring a certain number of new jobs to the area. Whether a development incentives package is large or small, or whether it is for a rural or urban area, an employment requirement is one of the most common conditions.

While on the surface this seems like a good idea, it misses one of the most important aspects of an industrial cluster, that of developing a geographically bound network of suppliers, service providers, and customers. If incentives are offered, they should also be tied to a requirement that a

certain percentage or dollar amount of inputs and services be purchased locally each year.

There are many advantages of a local content rule as part of a rural incentive package. First, it grows a network of value added enterprises that provide a core to the rural and small community clusters.

Second, with an established network of proven suppliers and service providers, the area becomes more attractive to other firms that use similar inputs.

Third, it provides an anchor to the larger firm. If a firm learns to rely upon the local market for inputs, the chance of retention is much greater – of course, make sure that the local content requirement includes important and critical inputs, not just stationary and office supplies.

Fourth, the multiplier effect on employment is highest for value-added intermediate economic activities. And finally, it creates a sense of good citizenship among the cluster.

Most technology firms want to source their inputs locally anyway. And if there are no qualified local suppliers, then part of the incentives package should be to train input providers.

Love Thy Entrepreneur

It is now well recognized that real economic progress comes from home-grown entrepreneurial activity, not from simply trying to attract another firm into the region. But there are different types of entrepreneurs.

Any good college textbook on entrepreneurship will have a section on the different entrepreneurial personalities. There are “serial” entrepreneurs or individuals that compulsively start and sell a number of different enterprises over time. There are “committed” or “lifetime” entrepreneurs that found, nurture, and grow a single business as their life work, ultimately hoping to pass it on to their children. These types of entrepreneurs seek out and exploit opportunities.

And then there are the “reluctant,” or “necessity” entrepreneurs. These are the

entrepreneurs that start a business because they have to. "Necessity" entrepreneurs have lost their jobs, they've been "downsized" or made "redundant." People need to provide for their family, so they sometimes start a business as their only option.

For the past two decades, less developed areas have been hit hard by unemployment. As a result, studies have found that many, if not most rural entrepreneurs are "reluctant" or "necessity" entrepreneurs.

Unfortunately, unlike the other types of entrepreneurs, "necessity" or "reluctant" entrepreneurs don't contribute much to economic growth. This is the conclusion of the Global Entrepreneurship Monitor (GEM) initiated by Babson College and the London Business School. The GEM study is the most comprehensive world-wide research effort that specifically examines the impact of entrepreneurship on economic growth.

As Professor Howard Frederick, a GEM director at New Zealand's UNITEC Centre for Innovation and Entrepreneurship summarizes, "high rates of necessity entrepreneurship contribute little to economic growth or innovation, according to our evidence from high-growth countries."⁴

Part of a successful rural technology economic growth strategy is to encourage more opportunity driven entrepreneurs, those that start enterprises because they want to, not because they have to. These are the people that take risks, inject capital, and expand the economic base of a community.

This will likely require a fundamental cultural change for many rural and smaller communities. We suggest a two pronged attack.

First, entrepreneurship and small business ownership must be presented to the community as a "noble" and "prestigious" profession. For example, a highly influential report has found that a major reason why business birth rates are so anemic in Scotland is that small business ownership is viewed as

a "low" profession, not something to be proud of.⁵

As a response *Scottish Enterprise*, the country's economic development agency, has recently embarked on a large scale public relations effort to change that image. Local entrepreneurs are publicized as economic "heros", and media coverage of entrepreneurial activities has been expanded. Rural communities in the United States could benefit from a similar effort.

Second, research has suggested that the best time to change attitudes about entrepreneurship and small business ownership is in early adolescence, starting at about age twelve. Economics and business essentials should be taught early in a child's life. The basic concepts of economic growth, supply, demand, risk-taking, money, and ethical management, need to be understood and appreciated early.

There is another benefit of early entrepreneurship training. Educational efforts such as entrepreneurship boot camps in junior and senior high schools has resulted in increased personal self-respect, more positive attitudes regarding small business ownership, and in some cases, actually reduced juvenile crime among disadvantaged teens⁶.

No Inventions Needed

How can we develop a technology center in our little rural community -- after all, we don't have the scientific base for research and development?

It's true. Most rural and small communities don't have much of a homegrown scientific base. At best there may be a community college or small regional university in the area, but generally there is little marketable science being

⁴ *Research Might Explain Why New Zealand Entrepreneurs Are Not Wealthy* (<http://www.homebizbuzz.co.nz/article.php3?ArticleID=980>)

⁵ *Promoting Business Start-ups: A New Strategic Formulation* (Fraser of Allander Institute, Glasgow), 2001.

⁶ See Rasheed and Rasheed, "Developing Entrepreneurial Characteristics in Minority Youth: The Effects of Education and Enterprise Experience: in Stiles and Galbraith (eds), *Ethnic Entrepreneurship: Structure and Process* (Elsevier, UK), 2004.

generated at these institutions – although a gem may be uncovered at times.

This is usually one of the most commonly cited barriers to rural technology clusters, but it is a false barrier. There is absolutely no need to invent science in order to use science for commercial purposes. The brilliant minds of the world have already done it. An entrepreneur just needs to license it.

Take the Bayesian Data Reduction Algorithm (BDRA) for example. Initially developed by the *Naval Undersea Warfare Center* in Rhode Island for enhancing image resolution for submarine sonar, the BDRA recently became available to the commercial sector. After additional development by the *Center for Commercialization of Advanced Technology*, a SPAWAR funded agency in San Diego, any private sector firm can now license the BDRA technology. Its powerful pattern recognition capabilities makes it attractive for a variety of business uses. In fact, the BDRA has been licensed by entrepreneurs who happen to be located in rural areas. These entrepreneurs didn't need to develop the technology; they just need to successfully commercialize it.

Like the BDRA, there are thousands of world-class technologies waiting to be licensed and commercialized. *TechLink*, a DoD technology transfer agency located in Bozeman, Montana has hundreds of available technologies from Department of Defense laboratories on their website. Similarly, NASA and other government laboratories generate licensable technologies. Another mechanism to acquire technology is a cooperative research and development agreement, or CRADA.

Also, every research university in the nation is anxious to license technologies developed by their faculty – and they are not all science based, but include educational, health, and business related technologies. It's a veritable shopping list of opportunities not only from the best technical universities in the world, such as Purdue, MIT, and Stanford, but outstanding state and regional universities as well.

University technology transfer offices will jump at the chance to work with rural entrepreneurs, particularly those within the same state. And best of all, the actual technology inventor will work closely with the entrepreneur; after all, they want their technologies to be successful also. Or one can go directly to the U.S. Patent Office website and do a key-word search on patents and contact patent holders directly.

The real job of the rural entrepreneur, hopefully with assistance from the local economic development office or local college's business school, is to "triage" the technology and make sure it's a competitive platform, develop a commercialization strategy, then attack the market. The problem becomes more of innovative commercialization than scientific invention.

In spite of the multitude of available technologies, the key focus still needs to be on the fundamentals of the start-up firm and the passion it brings to the market place. Getting the right technology complements the process.

Show Me the Money

Venture capital and other private equity investment funds tend to be concentrated in the large financial centers of New York, Boston, Chicago, and California. This presents a problem not only for rural and smaller communities, but also for large metropolitan areas that are located in states such as North Carolina, Alabama, Montana, and Missouri.

This concentration of equity capital creates several hurdles. First, there is simply less money available for other regions since people tend to invest in new enterprises that are in nearby communities. Second, even if a New York venture capital fund invests in a North Carolina start-up firm, most of the financial benefits will ultimately flow back to New York. And third, any non-local source of equity money will likely consider only relatively large deals. Small investments, such as the type most needed for technology firms in less developed regions, are simply

not worth the time and effort for outside and distant investors.

For rural technology economic development the moral of the private equity story is to keep it small, and keep it local. The most cited reason for entrepreneurial failure is "lack of capital," yet most entrepreneurship research indicates that firms can usually find success with far less capital than they think. The "lean makes mean" argument does indeed apply to the entrepreneurial life.

The GEM study indicates that the vast majority of entrepreneurial capital comes from personal or family sources. But while personal capital will certainly have to be invested, technology based nascent enterprises may also need to access other funds.

For a small start-up technology firm, an equity investment of \$50,000 can sometimes make the difference between success and failure. For this amount a start-up software firm could probably license a technology, hire a young programmer to develop a graphical user interface, develop a small local beta test, and shop their new product around. If carefully managed, \$50,000 or even less, can keep many small technology firms afloat for six months or so, particularly when combined other support such as low cost incubator office space.

Rural and smaller communities must actively develop deeply committed local "angel" equity investment networks. A good rural angel network might consist of ten to thirty local residents, each investing a relatively small amount of money on an annual basis. Perhaps once a month, they review business plans and proposals from local entrepreneurs. Investing only \$5,000 per member per year, a rural angel network could make several significant equity investments per year that support the local technology cluster.

Of course, most successful technology efforts will bootstrap a complete start-up package together by combining angel equity investment, bank financing, subsidized rural incubator support, small economic

development grants, and perhaps even partner with the local university for a Small Business Innovation Research (SBIR) government grant. But the best starting point for most of these bootstrap efforts is still a commitment of some equity capital.

The key to rural and small community cluster development is to create a complete mix of local funding mechanisms. This allows a local firm to seamlessly move between the various sources of capital as the business grows. There should be no local gaps in the funding spectrum between personal financing, angel seed money, grant funding, and bank debt financing. Any funding gap, no matter how small, will create a significant barrier to cluster development.

Technical, Technical & More Technical

Second only to quality of life and the SGT factor, access to a pool of technical workers is the most important criterion for high technology location, retention, and entrepreneurial start-up. For fourth generation rural and small urban technology centers, this pool does not need to be graduate level scientists, but rather a strong and sustainable pool of entry level technical workers. Young undergraduate engineers, computer programmers, software designers, lab technicians, health care workers, CAD/CAM operators, and graphic artists -- these are the types of job skills needed to anchor a small technology cluster.

Every regional university in the state, no matter how small, should have an undergraduate program in engineering, combined with one or two specialized graduate degrees. Every two-year community college should offer a broad selection of technical specialties. And every college advisor should encourage even liberal arts majors to minor or double major in a technical field.

One disturbing statistic is that the United States is falling further and further behind Europe, India, Japan, Korea, and even China in the percentage of technical degrees granted. It is impossible to sustain our lead

in technology and innovation without the core personnel.

Any state government or university system that does not aggressively encourage a broad range of engineering programs and technical degree offerings throughout its regional university system due to campus or partisan politics is simply not serious about developing a sustainable base of technology-driven economic growth.

The Cluster Champion

Innovation requires a champion, an activist who talks up the idea, knocks on doors, and takes personal and professional risks. The champion has that energetic and persistent personality that can make unlikely things actually happen. Tough skinned, the champion isn't easily sidetracked by rejection and delays. Hundreds of studies have shown that a champion provides one of the necessary ingredients for any successful innovation. Almost every major innovation can be traced to a champion.

The same is true for successful technology cluster development. Every new cluster needs a champion or activist. But a successful cluster champion needs to be more than just the local economic development officer. The most successful cluster champion is one that also carries personal risk to the effort. The cluster champion should be a local entrepreneur, plant manager, or angel investor, somebody who has a long term stake in the success of the new technology cluster.

Top of the Economic Food Chain

We do not suggest that these new fourth generation technology clusters will replace the Silicon Valleys of the world. Instead we believe that they will closely complement the other economic networks from earlier generations. In fact, a good economic development strategy may be to specifically design rural and small community technology clusters to act as satellite, or feeder clusters for the more established first,

second, and third generation technology clusters.

If possible, however, the rural or small community cluster should focus on industry sectors closer to the top of the "food chain," such as final assembly. The closer the targeted sectors are to the end user, the more economic growth is "pulled" through the community rather than being "pushed". But no matter what, a cluster will only be successful by targeting sectors that naturally fit with the region's perceived attributes.

In addition, with the decoupling of the various business functions, certain areas may be targeted for R&D, while other regions may be more appropriate for sub-assembly or engineering.

And finally, even within the same high technology industry, different firms will follow different strategies. Some firms will compete on price, while others will compete on more expensive features. A region's "attribute mix" must be carefully assessed in order to attract firms and entrepreneurs that value those regional attributes as part of the overall corporate business model and strategy.

In Conclusion

Rural and small community technology clusters are truly the fourth generation of technology centers. With the advent of highly transferable intellectual property, angel funded equity capital, distance learning, flexible manufacturing and cluster based manufacturing, the optimum scale of efficient technology based economic activity is shrinking. In many areas, high technology is becoming a "cottage" industry.

But not all rural regions and small communities will share in this success. The market for location is highly competitive, with no room for mistakes or delays. Both established firms and would-be entrepreneurs have a lot of choices, and these choices will be made just like any purchase decision.

Over the past two decades, the rural economic development and industrial cluster consulting business has expanded into a

virtual growth industry. Consultants and advisors will analyze a region's employment by industrial code, showing the percentages of labor in different sectors. They will develop indices of economic relationship, plot "cluster maps, and generate glossy reports full of tables and statistics. While these reports provide useful background information, they often seem to miss the fundamental point of sustainability.

A rural or small community technology cluster can only be successful if the basic economic and social structure is sustainable. And sustainability is ultimately derived from an ability to generate a regional set of attributes that is valuable, scarce, and not easily imitated.

This requires returning to the basics. Technology-based cluster strategies that don't directly address the SGT factor, the development of local angel networks, the incorporation of local content incentives, the licensing of external technology, the changing of attitudes about entrepreneurship, or the encouragement of cluster champions, will at best, be ineffective and non-competitive.

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