

21st Century Economic Strategy:
Prospering in a Knowledge-based Economy

Project Technical Memorandum:
Westside Economic Study

Joseph Cortright
Impresa, Inc.

With

Brian Bosworth
Brian Dabson
Heike Mayer
Lee Munnich
Mary Jo Waits

February 2002

For further information, contact Joseph Cortright, Impresa, Inc., phone 503-515-4524, or via email at jcortright@impresaconsulting.com.

21st Century Economic Strategy

Executive Summary

This memorandum briefly reviews the pertinent literature on economic growth and development, focusing on how the character of the future economy is likely to shape the opportunities for places, like the Westside, to influence their prosperity.

There are five key conclusions of this analysis:

- The globalization of economic activity is an accomplished fact and will continue to dominate the course of economic development for the foreseeable future. The overall growth of the economy will be driven by the production of economically valuable new ideas; those persons, companies and places that are most proficient in generating and applying new ideas will prosper; those that do not will struggle economically. Traditional sources of economic advantage, like access to raw materials, will dwindle in importance.
- Knowledge advancement and commercial success will primarily occur in conjunction with the development of industry clusters, dense networks of closely-related producers and consumers who push and feed on their collective knowledge-creating skills.
- Regions, particularly metropolitan areas, will be the competitive units in the new global economy. Place matters as a source of knowledge-creation and the locus for important institutions that shape knowledge and encourage entrepreneurship.
- Quality of life will be a paramount issue in determining which places can establish, maintain, and continuously regenerate the concentration of human capital (people with knowledge) on which regional innovative capacity rests.
- Local institutions and public policies will play an increasingly important role in establishing the underlying conditions for success in the knowledge-based economy.

This report was prepared by Impresa, Inc. for the Westside Consortium for Economic Health and has been researched and written by Impresa economist Joseph Cortright, with contributions from the reports co-authors. The views expressed are those of the author, and not necessarily those of the Consortium or its members. For further information about this report, please contact Impresa at 503-515-4524 or visit our website www.impresiconsulting.com.

Contents

Executive Summary	i
Contents	ii
List of Boxes	iii
Introduction	1
1.0 21 st Century Competitive Environment	2
2.0 Cluster Economics	13
3.0 Regions in Competition	17
4.0 Quality of Life and Competition	24
5.0 Strategies for Prosperity	27
References	35

List of Boxes

1. New Economy Characteristics	3
2. New Rules for a Knowledge-Based Economy	8
3. Cluster-Specific Institutions for Collaboration	15
4. Regional Competitiveness and Innovative Capacity	17
5. Principles for Action: How regional leaders can build the cornerstones of regional innovation	20
6. Building Regional Capacity for Innovation	21
7. Becoming a New Economy Leader	27
8. Four Pillars of Policy to Support a New Economy	28
9. Reshaping the Economic Environment	29
10. Economic Benchmarks for Public and Private Decision-makers	30

Introduction

The New Economy. These words are bandied about so frequently and with such general acceptance as to now be commonplace. With the advent of the Internet, the explosion of computer and telecommunication technology, and the re-acceleration of robust economic growth in the United States (at least until the recession that began in Spring 2001), it is clear to everyone that our economy is different today than it was only a decade or two ago. But as the dot.com bust reminds us, not all of the changes are even as sweeping or permanent as they may at first appear.

So what's "new" about the new economy? What should policymakers pay attention to, and what can they safely ignore in thinking about trying to secure prosperity in the decades ahead. There has been considerable research and investigation into the influence of key new economy trends, particularly in studying the role of knowledge in driving national and regional economies. This memorandum reviews that literature and summarizes the key lessons that regions, their citizens, leaders, and businesses should take to heart.

This analysis is divided into five major parts. Part I sets the stage, discussing the major implications of the advent of a global economy and the central role played by knowledge creation. Part II focuses on "industry clusters," groups of similar and related firms concentrated in particular geographic areas. There is now widespread agreement that clustering is central to explaining economic growth in the knowledge economy. Part III considers the importance of regions and the different attributes of regions to economic growth. Part IV widens the discussion to include quality of life, and to explore the connections between quality of life and economic development processes. Part V summarizes the major policy implications of these changes in the economy. In addition, throughout the report we have summarized the key insights of a wide range of "new economy" policy studies.

This memorandum is part of a study of the Westside Economy commissioned by the Westside Consortium for Economic Health. This is one of three parts of a technical analysis being prepared on the Westside Economy; two other memoranda address structure and performance of the Westside economy and the inter-relationship between the region's quality of life and its economy. Funding for this project has been provided, in part, by the Multnomah-Washington County Regional Investment Board with lottery funds from the Regional Investment Program of the Oregon Economic and Community Development Department. The principal author of this report was Impresa economist Joseph Cortright. Heike Mayer wrote sections of this report dealing industry clustering. Responsibility for the analysis and opinions expressed in this memorandum lies with Impresa, Inc.

1.0 21st Century Competitive Environment

The competitive environment of the 21st century will be very different from that of the 20th century. Much of the 20th century was concerned with the growth and development of nation-states and nationally concentrated markets and industries. Important changes in technology, including the widespread adoption of electricity, commercial aviation, inexpensive telecommunication, and powerful computers all reshaped the economy over the course of this century. In the 21st century, some trends will continue and other new ones will emerge. This section considers the implications of globalization and the continuing shift to a knowledge-based economy, and what effects these trends will have on the opportunities for local economic prosperity.

1.1 *The Implications of Globalization*

Local economic leaders face a formidable challenge in the 21st Century: enabling their communities and businesses to compete effectively, not simply against rivals in other states, but against workers and firms throughout the world. The traditional policy tools that economic developers have employed in an era of domestic competition are ill-suited to the changed circumstances that American businesses and American workers now face. We will need to understand the changes in the global economy, the rapid changes in the nature of competition, in order to fashion effective policies to better their economic prospects.

For most of the twentieth century, the United States has been the world's unquestioned economic leader. Our economic dominance was based on our invention and perfection of systems of mass production and mass marketing, systems which, when coupled with America's vast domestic market, laissez faire economic system and abundant resources, gave the U.S. the largest and richest economy in the world.

The U.S. was able to tap huge economies of scale in production that were simply unavailable to foreign rivals confined to smaller and poorer domestic markets. As U.S. firms grew bigger, they made technical progress faster, and with access to world-leading research and development, pioneered and dominated new industries like aerospace and electronics.

But over the last several decades, the huge U.S. lead has diminished as Western European and Japanese industries have emulated or surpassed U.S. accomplishments. Experts differ on whether U.S. businesses are ahead of or behind their international competitors. Aggregate data from the Organization for Economic Cooperation and Development show that U.S. workers rank fourth in output per worker among the G-7 major industrial powers, behind Japan, Germany, and France. Other studies show that U.S. workers are still more productive in some industries, like food processing and computers. Even so, American companies which once dominated global markets have lost market share in automobiles, steel, banking, chemicals, and textiles. While economists may disagree about the numbers, it is now clear that the rest of the industrial world has virtually caught up technologically and economically to the level of American firms and workers. What may be more important is that the erosion of America's economic lead has been accompanied by a profound impact on

American living standards: during the decade of the 1980s, real earnings for the average U.S. worker declined by nearly ten percent.

U.S. Domination of Global Products has declined sharply
U. S. Share as a Percent of Worldwide Sales of the 12 Largest Companies in Each

Industry	1960	1970	1980	1990
Automobiles	83%	66%	42%	38%
Banking	61%	67%	26%	0%
Chemicals	68%	40%	31%	23%
Computers	95%	90%	86%	70%
Electricals	71%	59%	44%	11%
Iron & Steel	74%	31%	26%	12%
Textiles	58%	44%	41%	21%

Source: (Franko 1991)

Box 1: New Economy Characteristics

- Technology is a Given
- Globalism is Here to Stay
- Knowledge Builds Wealth
- People are the Most Important Raw Material
- There's No Such Thing as a Smooth Ride
- Competition is Relentless
- Alliances are the Way to Get Things Done
- Place Still Matters—But for Different Reasons

(Waits 1999)

The most convenient policy choice would, of course, be to turn back the clock to the period of American economic supremacy. Not only is this not possible, but the adoption of the North American Free Trade Agreement (NAFTA) and the signing of the new General Agreement on Tariffs and Trade (GATT) signal our continuing commitment to sink or swim in a global marketplace. And, more to the point, the old model of mass production is daily being copied in the developing nations of the world, whose labor costs are a fraction of our own.

1.2 The New Economics of Knowledge-Based Growth

As technological change has reshaped the economy, it has prompted a re-examination of some of the theories we use to explain what makes economies work. While economists have not made complete sense of all of the unfolding changes in the economy, some important new strands of thinking are gaining widespread recognition. A relatively recent school of economic thought, called “New Growth Theory”, makes knowledge creation a central part of the explanation for what makes economies grow. New Growth Theory, pioneered by economics professor Paul Romer, has several key implications for places looking to secure their prosperity in an economy increasingly based on knowledge.

Conventional neoclassical theories are based on the accumulation of two things: capital and labor. Economists have said both of those things have decreasing returns and, eventually each additional increment of labor and each additional increment of capital will produce decreasing returns, which in the traditional classical theories say, growth is going to come to a grinding halt at some point. The reason that we know that it hasn't is because technology has gotten better.

Knowledge has gotten better. We all know that is true, but economists had a hard time fitting knowledge into their models because unlike capital and labor which exhibit decreasing returns, knowledge exhibits increasing returns. I can give you all the knowledge that I have, however useful that might be, and I can give it to all of you and not be deprived of the use of it myself. We see the economics of increasing returns to knowledge in a variety of high tech industries. The marginal cost of Microsoft producing an additional piece of software is zero. There are huge increasing returns in that industry and in other knowledge-based industries as well.

One of the implications of this knowledge-based economy is that we move from the economy of scarcity, which economists are very good at dealing with, with the potential economy of abundance. Markets don't necessarily deal with these knowledge commodities really well. In essence, the thing to think about knowledge is, we have grown our economy not so much by creating more things but by developing new ideas. The reason we are richer today than a hundred and fifty years ago is not because we have more clipper ships and more oxen. It is because we have invented things like cargo containers and a whole range of other ideas, large and small, that enable us to enjoy a higher standard of living. That will be the source of growth forever.

Knowledge Drives Growth

The key aspect of New Growth Theory is to explicitly make new technology (and not capital and labor) the central explanation for continuing growth. New technology and new knowledge have a fundamentally different characteristic than other economic goods: they are non-rival. Non-rivalry means that any one can make use of them without diminishing anyone else's use of them. An old, and important concept; Jefferson once remarked: “He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me.”

To the economist, non-rival goods are not subject to decreasing returns; in fact, they exhibit increasing returns (one gets more and more output without having to

recreate the idea anew each time). As a result, the economics of ideas points to a new, and decidedly optimistic view of our economic prospects. Ideas are not subject to the limits of scarcity, but to the potential of abundance. The opportunities to improve ourselves by coming up with better ideas seem to be limitless.

And while the pace of technological change in the last decade or two seems to be underscoring the importance of new technologies and new ideas to growth, we shouldn't lose sight of the fact that ideas have really been the driving force for economic growth all along. Our development and prosperity don't result primarily from our accumulation of physical capital or our expanding supply of labor. The reason we enjoy a higher standard of living today than a century and a half ago, as Paul Romer has pointed out, is not because we have accumulated more oxen and clipper ships, but because we have invented tractors and container ships, and millions of other ideas great and small that have enabled us to accomplish more.

"Over the past century, by far the largest part of the growth in America's real gross domestic product is the result of new insights and, more broadly, new information about how to rearrange physical reality to achieve ever higher standards of living.(Greenspan 2000)

Knowledge-based Growth is Evolutionary and Unpredictable

The central role of knowledge in driving economic growth has important implications for the way in which economies grow. Knowledge-based growth is the growth of an evolutionary system, not simply a Newtonian balance of supply and demand that always seeks equilibrium. The evolutionary framework implied by knowledge-based growth means that both the micro behavior of economic actors (firms, workers, and consumers) and the overall path of economic development can be pictured by invoking analogies to biological evolution. Individual actors don't maximize their utility in ceaseless calculations of alternatives; they muddle along, relying on previously successful behaviors until they are proven unsuccessful, and then trying alternatives that draw from their own experience. The result, when multiplied over the scale of the entire economy, is an economic system that evolves.

The science of economics arose, hand in hand, with the Enlightenment in the 17th and 18th Centuries. Adam Smith, wrote *The Wealth of Nations* in 1776. One of the dominant scientific paradigms of that day was Newtonian physics—the notion that natural systems, ranging from the infinitesimal to the cosmic, could be imagined as a series of elaborate balances always tending toward equilibrium. Arguably the models and metaphors of 18th century physics were imprinted on the great economic thinkers of that time, and were reflected in the vision that economists had of the system they sought to explain.

Economists have only recently begun to systematically explore the developmental implications of increasing returns and path dependency. One of the most interesting examples of path dependence is literally right at our fingertips. Almost every computer keyboard in the western world follows one cryptic arrangement in use for more than a century, with the letters QWERTY in the upper left-hand corner. This design dates to the 1870s, and was chosen to prevent the long levers that pressed the type against the ribbon from clashing

with one another, and so, it is said, that a salesman could type the word “typewriter” using only the keys on the top row.

The reasons behind the persistence of the typewriter keyboard tell us much about the development of technology, argues historian Paul David. Three characteristics of QWERTY and similar technologies produce this sort of lock-in: technical interrelatedness, economies of scale, and quasi-irreversibility (David 1985). Technical interrelatedness is the complementarity between the physical arrangement of the typewriter keyboard and the typist’s human capital of touch typing. Both the keyboard and the typist have to standardize on the same arrangement of keys in order to achieve efficiency. Economies of scale refer to the relationship between the number of users of a particular technology and the incentives facing new adopters. In the case of QWERTY, early touch typists chose to be trained on what was initially the most common keyboard arrangement. Similarly, typewriter manufacturers looked to produce models that could be used by the largest number of trained typists. While early on there were several competing arrangements for keyboards, by the mid-1890s, QWERTY had become virtually universal. That this situation persisted—for more than a century now, in spite of the transition to an entirely new technology, computers—is a product of the quasi-irreversibility of the investments by manufacturers and touch typists. While manufacturers could easily change the layout of the computer keyboard (and even end users can now do so by software), and keyboard users can retrain themselves in a new layout, no one does because all the other keyboards and computer users in the world have standardized on the QWERTY design.

The presence of "QWERTYnomics" has been noted in a wide variety of other technologies. The triumph of VHS standard video recorders over what many regarded as a technically superior Beta technology clearly followed the increasing returns dynamic: a small lead in market share prompted broader availability of products on VHS and further increased demand for VHS recorders. Eventually VHS drove Beta from the market.

QWERTYnomics implies path dependence: where economies end up is a product of the development path that they follow. Small chance events occurring at the right time can have persistent long term effects.. Economies can lock-in to particular, often inefficient, technologies or other arrangements, and market forces will not automatically correct these inefficient outcomes (Arthur 1987).

QWERTYnomics applies with great force to industrial location. Because of the complementarities between producers and suppliers, employers and workers, firms in a single industry may find it advantageous to be located in the same community. Once a particular location is established as a center for a particular industry, new firms and new workers have powerful incentives to locate there. Paul Krugman has used this notion to build several sophisticated models of industrial location. The same concept has applicability to international trade as well: industries that exhibit increasing returns may not simply be dominated by one company or one city, but by a single nation as well (Krugman 1991a).

What are the policy implications of QWERTYnomics? Because small historical events can play a decisive role in the development of technology or the location of industry, it is possible that government interventions can produce a potentially better set of outcomes than the market alone. For example, policies to support an emerging industry can create a self-reinforcing cycle that leads to the

development of enduring competitive advantage in that industry (Krugman 1994). In thinking about technological development, it may be wise for public policy to discourage markets from prematurely locking in to a particular technology before its costs and the implications for further development are understood (David 1997).

1.3 Change is the new constant

Another critical implication of knowledge-based growth is that change—always continuing, seemingly ever-more rapid change in markets, technology, firms, and other central aspects of the economy—are an inherent part of our economic future. Almost by definition, achieving economic prosperity will require the ability to cope with change. As economist Paul Romer writes:

The conventional view of economics, crystallized by Alfred Marshall in the late 19th century was of the economy as a well-balanced system, always tending toward equilibrium. All of the forces acting on the economy generated signals or reactions that tended, over time, to push the economy toward an optimal state. A shortage of some particular good or service was associated with a rise in its price, which in turn called forth additional resources to produce it, ultimately triggering a greater supply and a reduction in its price. The view of economic change afforded by this model of the economy is one of smooth and continuous adjustment.

This view was challenged by Joseph Schumpeter, who argued that economic change was almost exactly the opposite: abrupt and discontinuous, rather than smooth and orderly. Schumpeter proposed that the search for higher than normal profits (quasi-rents, in economic jargon) led individuals and firms to innovate, to seek unique new practices and technologies. New products, almost by definition, give the businesses producing them a monopoly, if only a temporary one, and enable firms to earn higher profits until their product is successfully imitated by a competitor or displaced from the market by yet another new product. New businesses, with new ideas, changing the definition of markets, not simply lowering the price of some commodity, are the driving force behind change.

In this view, economic change is not the result of slow movement from one equilibrium to another, but is driven by the pursuit of the quasi-monopolistic profits that accrue to innovators. Economic change is propelled by the succession of technologies and practices that destroy old, inefficient arrangements as newer more efficient ones are created. New ideas are frequently created by new firms: the business that builds the first railroad is seldom the business that previously operated the stagecoaches (Schumpeter 1934). New businesses develop new ideas that displace the old ones. The result is what Schumpeter calls “creative destruction.”

Paul Romer echoes Schumpeter’s argument about the disruptions inherent in economic progress. We achieve higher productivity by instituting new processes, procedures and organizations that invariably displace old ones. The displacement produces real losses to those whose jobs or investments were tied to old ways of doing things, but absent this creative destruction, there is no technological improvement. Romer offers a metaphor drawn from physical training. Swimmers work to improve their speed by a combination of physical training and modifications to their technique. Using any given technique, once a

Box 2 New Rules for a Knowledge-Based Economy

Rule 2: Successful businesses must be willing to cannibalize themselves to save themselves. They must be willing to destroy the old while it is still successful if they wish to build the new before it is successful. If they won't destroy themselves, others will destroy them.

Rule 3. Businesses that would grow rapidly with high profit margins must take advantage of technological disequilibriums, exploit developmental disequilibriums, or create sociological disequilibriums. All other activities are slow-growth, low-rate-of-return commodity businesses.

Rule 4: Understanding, recognizing and accepting the limits imposed by their genetic weaknesses is the beginning of wisdom for all organizations. The secret of success is finding places to employ one's resources where those weaknesses are irrelevant.

Rule 6: There are no institutional substitutes for individual entrepreneurial change agents. The entrepreneur winners of the game become wealthy and powerful, but without entrepreneurs economies become poor and weak.

Rule 7: Any society that values order above all else will not be creative, but without the right degree of order, creativity disappears as if into a black hole.

Rule 8: The economic payoff from more social investment in basic research is as clear as anything is ever going to be in economics.

Rule 10: The biggest unknown for the individual in a knowledge-based economy is how to have a career in a system where there are no careers.

Rule 12: Economic and environmental progress are synonyms—not antonyms.

(Thurow 1999)

swimmer has achieved a high level of physical conditioning, it is no longer possible to generate improvements in performance. The only option is to modify the technique. But modifying a technique almost always produces a short-term decline in performance as the swimmer struggles to become as precise and effective with the new stroke as she was with the old (Romer 1994).

Romer maintains the same tradeoff—short-term dislocation to learn techniques that are ultimately more efficient (“no pain, no gain”)—applies with equal force to the economy. Rearranging the economy to produce new goods or services, means some of the firms, workers, and equipment used in the current production will be displaced.

Most of Romer's work focuses on the long run: how much economies grow over periods measured in years, not the quarter to quarter fluctuations that get media attention. But New Growth Theory also has important implications for how we view business cycles. Recessions are in large part a period of time in which the

job losses caused by destruction of the old are concentrated, and for that time exceed the job gains from the ongoing creation of the new.

The economy is in a continuous state of upheaval, with new businesses being created, existing businesses expanding (and contracting), and other firms failing. While this occurs even in good times, there is evidence that the process of failure and contraction is even more pronounced in recessions (Davis, Haltiwanger et al. 1996). In Romer's view, much of this job destruction is part of the natural process of replacing outmoded technologies. Businesses that are marginalized by technological change may continue to function in good economic times, but are too weak to weather recessions, resulting layoffs and business closures.

Creative destruction has a straightforward policy implication. Efforts to maintain the current arrangements of firms, markets, and technologies may have the effect of retarding the development of more efficient and sustainable activities. Places seeking economic development need to assure that they are good locations for the development of new ideas, and often the formation of new firms, if they are to be able to succeed in an increasingly global, knowledge-based economy.

1.4 A Revolution in Production

Accompanying the shift to a knowledge-based economy has been a fundamental change in the way production is organized in the economy's most successful industries. The model we used to achieve global pre-eminence is being superseded by a new model of production, better suited to the technology and markets of the 21st century.

The U.S. achieved global dominance by being the first nation to effectively implement standardized mass production. Using principles of scientific management, the production of complex products--like cars--was decomposed into a series of simple steps, each of which could be repeated several hundred times per day by a relatively low-skilled worker. An administrative superstructure of supervisors, engineers, planners, accountants, and others ran the process. With mass production, Henry Ford and his imitators provided enormous output at low cost, but at the price of great rigidity and often indifferent quality.

In its heyday, American mass production outperformed the traditional European system of craft production because it enabled each of thousands or millions of units of production to embody the best design without having to laboriously train each worker as a craftsman.

When an industry's market was national and composed of relatively homogenous customers with a simple range of tastes and preferences, and technology changed slowly, the mass production model worked extremely well. But as technological change has accelerated and markets have decomposed into tiny niches divided by income, age, neighborhood characteristics, and lifestyle choices, the rigidity of mass production has increasingly become a liability. Product life cycles have grown shorter and shorter, and customers have come to expect products that are more closely tailored to their specific needs and demands, and also have the willingness and ability to pay for higher quality.

We have gone from an era in which economic success was determined by static efficiency --defined largely as the ability to achieve the largest scale of

production and the lowest costs-- to dynamic efficiency: the ability to continuously improve old products and processes and develop new ones. This is the essence of business advice from strategists like Tom Peters and Peter Drucker: innovate or die (Peters 1987).

More and more, the best firms in the world are turning to a new model of production, one that turns the old approach on its head. There are many names for this new model of high performance work organization: flexible manufacturing, total quality management, lean production, and even innovation-mediated production. The key characteristic of this new system of work organization is that it continuously innovates and adapts to changes in markets, and to constantly improves techniques and technology.

High performance is applied differently by different businesses, but generally encompasses a close-knit series of central principles. Hierarchies are flattened, and more responsibility is shifted to front-line workers. Self-managed teams replace rigid assembly lines. Detailed systems of job classification and elaborate work rules give way to extensive cross-training and flexible work assignments.

High performance work organization is inextricably linked to the development of improved information and communication technology. Indeed only those firms that significantly reorganize their management and production systems, generally along high-performance lines, are able to fully harness the benefits from new computer and telecommunication investments (Brynjolfsson and Hitt 1999).

Nowhere is the difference between the new and the old methods of production better understood or better illustrated than in comparisons between traditional U.S. and Japanese automakers. Japanese firms using the lean production model assemble cars with 25 percent fewer worker hours, introduce new models months faster, achieve higher quality, and have more satisfied customers. American automakers have regained some market share in recent years, principally because they have successfully adapted many aspects of the lean production model to their own operations.

Why does high performance work? At its heart, innovation is about knowledge-creation--figuring out better ways to do things than before, and then applying that learning throughout a company. There are two particular aspects of learning that are important in an economic context. First, learning is incremental. While Nobel-prize scale innovations capture public attention, they seldom translate into competitive advantage for a particular firm or nation because they are so universally available. Recent breakthroughs in room temperature superconductivity were replicated in labs around the world within days of the first publication of results. The real economic value of learning comes from very small steps--just getting a little bit better each day. This kind of learning isn't easily observed or copied. A second aspect of learning is that it is particular. We generally conceive of learning by business as being a separate activity, usually conducted by separate research and development staff. But incremental learning happens everyday and on the shop-floor. To translate learning into economic advantage, businesses have to put the results of these small steps in the hands of all employees, not just a few.

This ongoing transformation in production systems is central to the economic challenge facing American firms in the global economy. The future economic health of a nation or state may depend largely on the ability of its firms and

workers to rapidly adopt and successfully deploy the new models of high performance work organization.

1.5 Traditional advantages are likely to disappear

Resource availability has traditionally been viewed as a critical factor in the location of economic activity. In historically important industries like agriculture and forestry, the availability of natural resources, like water and appropriate soils, effectively dictated the arrangement of business and industry. More generally, differences in the availability of resources between places shape the competitive advantage of firms in different locations. Resources that are equally available everywhere have no effect on the location of firms. Some resources, like an atmosphere with 16 percent oxygen, paper, or light, are absolutely essential to conducting business. But since they are available equally at almost every imaginable location, they have no effect on the distribution of economic activity.

Over time, accessibility of resources changes—technology changes, transportation systems improve, prices change, and so on. The unmistakable historical trend—one that has accelerated with globalization—has been that more and more resources have come to be available almost everywhere: what was once scarce is now ubiquitous. When resources become ubiquitous, their importance to the location of economic activity evaporates and is replaced by other factors that are not omnipresent in the economy (Maskell 1998). For example, motive power throughout most of history was limited to locations with falling water. Mills and machines could only be located in such places, and falling water dictated the location of some industry. With the advent of steam power and later electricity, motive power became essentially pervasive, and now access to motive power is not a decisive factor in the location of industry, with the possible exception of large-scale power generation.

This process of ubiquitification has been accelerated by the rapid progress in particular kinds of technology, especially improvements in transportation and communication. Improved transportation makes the physical proximity of things less relevant, improved communication makes the physical proximity of information less relevant. Because the logistical needs of business can now be met almost anywhere, businesses are increasingly emphasizing access to employees, particularly professionals with specialized skills, in their locational decisions, a point now emphasized even by transportation economists (Pisarski 1999). As Michael Porter concludes:

Anything that can be efficiently sourced from a distance has been nullified as a competitive factor in advanced economies, and while global sourcing may mitigate advantages it does not create advantages. (Porter 1998).

Regions and their economic development policy leaders need to recognize that while preferential or proximate access to certain resources may have been important, even decisive, in their past, economic growth will assure that access to a new and different set of resources—particularly those resources relating to creating knowledge—will be more important in the future. As in business, the challenge for regions will be the willingness to shift their strategies to new forms of advantage, to render their old advantages irrelevant, before their competitors do it for them (Thurow 1999).

2.0 Cluster Economics

How do businesses that operate in a global knowledge-based economy stay competitive and innovative at the same time? In today's economy, knowledge advancement and commercial success primarily occur in conjunction with the development of industry clusters, dense networks of closely-related producers and consumers who push and feed on their collective knowledge-creating skills.

The concept of industry clusters was first explored by Harvard Business School professor Michael Porter. In his study of the competitive advantage of national economies, he concluded that location characteristics play an important role in the success of a region's industries (Porter, 1990). By introducing geography-specific factors into the analysis of regional economies, Porter offers a new framework for economic development. Instead of focusing on factors inside the company, the industry cluster approach suggests "that a good deal of competitive advantage lies *outside* companies and even outside their industries, residing instead in the locations at which their business units are based." (Porter, 2000, p.16)

What are industry clusters and how do they work? According to Michael Porter, clusters are groups of similar and related firms concentrated in a small geographic area (Porter, 1998). To make a cluster function, they must consist of interconnected firms in the same fields, specialized suppliers, service providers, firms in related industries, and associated institutions (such as trade associations, universities, technology transfer centers, etc.). Through their competitive and cooperative dynamics, industry clusters are successful in creating competitive advantages to the firms that are located in them.

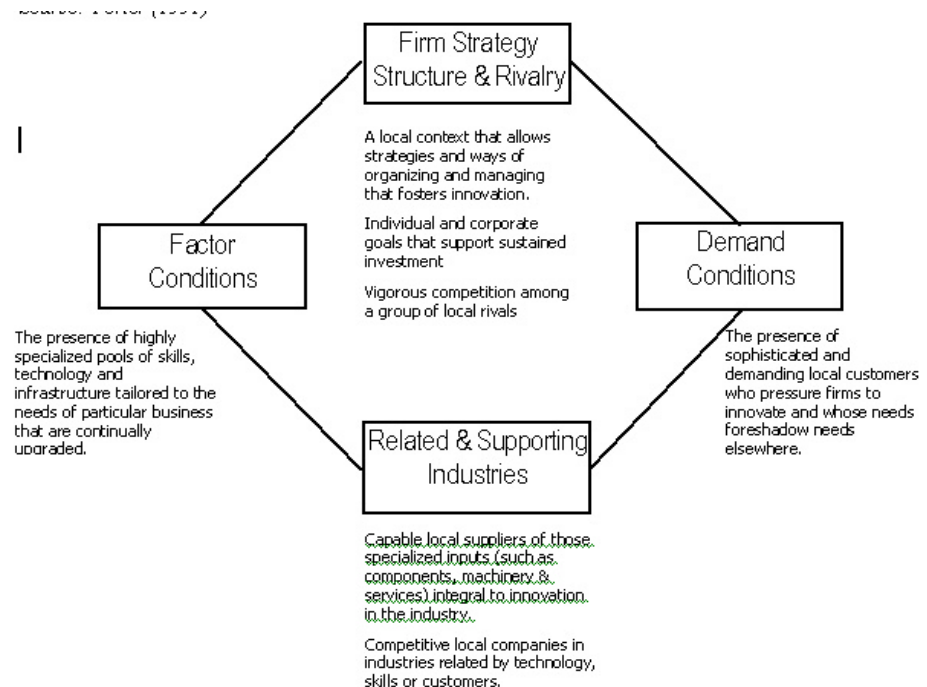
While much of the discussion of industry clusters centers on high technology agglomerations like Silicon Valley, where clustering is powerfully in evidence, Paul Krugman has shown that, far from being the exception, the clustering of industries in particular metropolitan areas or regions is the norm, both in high tech and low tech industries. He notes that one of the most famously clustered industries—the U.S. auto production complex in southern Michigan and the adjacent portions of Ohio and Indiana—is only slightly above the median level of spatial concentration for all U.S. industries (1991). From jewelry in Providence, Rhode Island, to recreational vehicles in Elkhart, Indiana, to medical devices in Minneapolis-St. Paul, Minnesota, such clustering is a common phenomenon.

Porter's industry cluster framework provides a new perspective on the determinants of regional competitive advantage. Traditionally, economic developers have thought that they can influence a region's economy by lowering the costs for doing business in their areas. Corporate incentives such as tax breaks for individual firms were the tools of choice. But cluster thinking goes beyond the narrow cost-based view of the business environment by focusing on an extended set of factors that influence the competitive advantage of a group of firms. Within this view, public policy efforts become more effective because they not only affect one individual company. Rather, an industry cluster comprised of a set of interrelated firms benefit from such efforts.

Porter's industry cluster analysis is summarized in the diamond of competitive advantage (Porter, 1990). The four components of the diamond are:

- Firm strategy and rivalry
- Demand conditions
- Related and supporting industries
- Factor conditions

If a region succeeds in developing an industry-specific diamond, then the region's industry cluster can be competitive in the global economy because individual firms belonging to the cluster can draw on specialized services, inputs, and related industries. Thus, Porter's diamond powerfully describes the mechanics of industry cluster competitiveness.



The four elements of Porter's diamond deserve highlighting because they are integral to understanding why industry clusters are more competitive than firms that are isolated from others.

- Firm strategy and rivalry:
This aspect of the diamond refers to the conditions governing corporate organization and aspects of rivalry among firms in the same cluster. If cluster firms choose to continuously upgrade and invest, then they will remain competitive. Additionally, if these firms compete with others in the same industry cluster, they will be motivated to constantly innovate in order to differentiate themselves from their rivals. Both firm strategy and rivalry contribute to regional competitiveness drawing on regional innovation dynamics.

- Demand conditions:
The presence of sophisticated and demanding local customers will force industry cluster firms to continuously innovate and stay on the leading edge. Cluster firms must cooperate with their customers in order to meet their needs. Additionally, meeting the demand of sophisticated local customers will help cluster firms to compete more successfully in global markets.
- Related and supporting industries:
The third aspect of Porter's diamond refers to the presence of capable, locally-based suppliers and of competitive related industries. These supportive industries create a web of necessary providers on which firms can draw upon. Cooperation between firms and their suppliers creates innovation because it is vital to these firms to exchange information and knowledge about new processes and products.
- Factor conditions:
These include factors of production such as a skilled labor force, specialized infrastructure, educational institutions that all firms in the cluster can draw on. Porter states that "to increase productivity, factor inputs must improve in efficiency, quality, and (ultimately) specialization to particular cluster areas." (Porter, 2000, p.20) Such specialization will contribute to increased productivity. And if specialized factor conditions are only available at one location, then it is less likely that the same set of conditions will be available elsewhere. Thus, demand for services and products from firms in this specific cluster will rise because no other location provides the same set of services and products.

Porter concludes that "the cluster is the manifestation of the diamond at work. Proximity, arising from the co-location of companies, customers, suppliers, and other institutions, amplifies all of the pressures to innovate and upgrade." (Porter, 2000, p.21)

Industry clusters increase the capacity of firms to innovate and grow their productivity. A cluster enhances productivity by providing firms with the privilege of accessing specialized inputs and employees, as well as unique information and knowledge. Firms that are connected to other firms and whose employees are part of cluster networks, will ultimately have an advantage because they are able to more rapidly respond to market needs. Firms that recognize the benefits of information and knowledge flows will benefit because they notice new technological or market possibilities faster than others. However, in some occasions clusters can pose obstacles to innovation. This is the case when members of the cluster become locked-in into certain ways of thinking which tend to reinforce old behaviors instead of promoting new ideas for improvements (Grabher, 1993).

Economic development policy based on the industry cluster approach has the advantage of developing a public policy approach that is based on the provision of services and improvements to the business climate to a group of firms rather than individual firms. Additionally, cluster-based economic development policies will be more effective because they take a broader set of factors into account that influence regional economies. Along these lines, Ed Feser, economic

development scholar at the University of North Carolina, states that "one of the hallmarks of the cluster approach is the implementation of holistic and comprehensive development strategies that account for the full range of factors influencing the success of a given sector or set of sectors. It stands to reason that many of these factors will fall outside the purview of the typical set of individual initiatives and tools." (Feser, 1998, p.21)

Box 3: Cluster-Specific Institutions For Collaboration

- Promote cluster awareness.
- Engage in ongoing diagnosis of cluster's competitive position.
- Compare position relative to other regional clusters.
- Identify constraints, obstacles, and advantages.
- Develop training and management programs.
- Provide programs through institutions for collaboration.
- Coordinate with local institutions to provide programs.
- Actively participate with government in recruitment efforts.
- Communicate with firms in clusters to identify gaps in the cluster and recruit accordingly.
- Widen institutional membership to include all cluster constituents.

(Porter 2001)

Cluster development is in many ways closely related to the growing importance of the knowledge-based economy. The process that creates and sustains these industry agglomerations in particular places is in large part a process of knowledge creation. Groups of firms compete fiercely against one another to achieve a technological edge, building their own knowledge, as well as building and drawing on the knowledge of customers, suppliers, workers, and others. Industry clusters tend to be vibrant sources of innovation, both in existing companies and through the creation of new businesses.

Because they are driven in no small part by the QWERTY-dynamics of knowledge-creation, industry cluster growth shows the same positive feedbacks and unpredictability in space that the evolution of technology shows over time. "Small accidental events start a cumulative process in which the presence of a large number of firms and workers acts as an incentive for still more firms and workers to congregate at a particular location. The resulting pattern may be determined by underlying resources and technology at some very aggregate level; but at ground level there is a striking role for history and accident" (Krugman 1991b, page 67)

3.0 Regions in Competition

3.1 *Regions are the Unit of Competition*

The traditional view of economic competition has been that nations compete against other nations, that states compete against other states, or that individual companies compete against other companies. There is a growing recognition among economists, business strategists, and geographers that especially in a knowledge-based economy, the crucial competition is between different metropolitan areas and their ability to nurture successful industry clusters. In the past several years, scholars have increasingly come to emphasize the key role that location plays in economic growth. Many have come to echo the sentiments of urbanist Jane Jacobs, who outlined the seminal role that cities play in innovation and the development of new ideas, products and processes. Luminaries from such diverse fields as business strategy, international trade theory and political science, like Harvard's Michael Porter and Robert Putnam and Stanford's Paul Krugman, are pointing to the critical role that cities and their surrounding geographic regions play in driving economic progress. Porter writes:

Indeed, falling communication and transportation costs and the reduction in barriers to trade and international competition make locational advantages of industry innovation even more significant, because firms with true competitive advantages are more able to penetrate other markets. While classical factors of production are more and more accessible because of globalization, competitive advantage in advanced industries is increasingly determined by differential knowledge, skills and rates of innovation which are embodied in skilled people and organizational routines. The process of creating skills and the important influences on the rate of improvement and innovation are intensely local. Paradoxically, then, more open global competition makes the home base more, not less, important (Porter 1990).

Porter's thinking is echoed by Rosabeth Moss Kanter, author of a book examining what it will take to succeed in the new economy, concludes:

The global economy makes it clear that the success of businesses derives heavily from their linkages. They draw strength from relationship-based social capital, as well as from financial capital. Therefore cities need to be the places where linkages can be forged and facilitated. Cities will thrive as international centers to the extent that the businesses and people in them can learn more and develop better by being there, in communication with each other, than somewhere else (Kantor 1995).

Similarly, business strategist Kennichi Ohmae argues that it is not meaningful to speak of entire nations as economic units, and that the national averages used to describe and compare economies mask critical variations in development and competitiveness within nations. In his view, nation-states have become little more than bit actors, regions, and region states, will be the dominant locus of economic competition from here on out (Ohmae 1996).

This consensus about the continued importance of place even in a global economy seems to fly in the face of conventional wisdom about the effects of improving technology. The advent of increasingly sophisticated high capacity communications technologies, particularly the Internet, reinforces the perception that information can be moved with no costs from place to place. Popular books have proclaimed the “death of distance” and led some to predict that geography, borders, and time zones are all rapidly becoming irrelevant to the way we conduct our business and personal lives (Cairncross 1997).

While many believe that place is becoming irrelevant in the new economy, the recent evidence on the influence of industrial clusters on regional economic success, particularly in knowledge-based industries suggests not. In fact the opposite may be true. One of the leading scholars of knowledge-based economics argues:

As the world becomes more and more closely integrated, the feature that will increasingly differentiate one geographic area (city or country) from another will be the quality of public institutions. The most successful areas will be the ones with the most competent and effective mechanisms for supporting collective interests, especially in the production of new ideas.”(Romer 1992, p. 89).

Box 4: Regional Competitiveness and Innovative Capacity

- The economic goal for regions should be a high and rising standard of living.
- This depends upon creating a high-quality business environment that fosters innovation and rising productivity.
- Strong and competitive clusters are a critical component of a good business environment and are the driving force behind regional innovation and rising productivity.
- The prosperity of a region depends on the productivity of all its industries.
- Productivity does not depend on what industries a region competes in, but on how it competes.

(Porter 2001)

To understand the reasons for the paradoxical importance of location in a more closely connected world, it helps to examine the roots of the thinking about industry location. A standard assumption of economic theory is that all economic actors have perfect information, not only in terms of prices and alternatives, but also in terms of access to technology. We act as if production functions are akin to chemical formulas or simple recipes that everyone knows. Under this assumption, regional differences in knowledge about markets and technology don't and can't make any difference to the location of economic activity. But this assumption is wrong. Economically valuable knowledge is complex and deeply imbedded in certain individuals, firms, and social organizations. Empirical studies confirm that there are technology gaps between

regions even in advanced economies (Caniels 1996). A key reason for these knowledge or technology gaps stems from the distinction between explicit and tacit knowledge. While explicit knowledge can be written down and transmitted—and conforms more closely to the classical notion of widely available recipes—tacit knowledge, or know how, derives from experience and relies on innate judgment and common sense and can't easily be communicated (North 1990).

While the distinction between tacit and codifiable knowledge is a useful one for thinking about knowledge spillovers, it is useful to recognize that knowledge can be transformed from one type into the other. Economic forces prompt firms to undertake the steps (developing procedures, training, evaluating, etc.) needed to achieve this transformation.

Recognizing the difference between tacit and codified knowledge helps incorporate geography into the knowledge economy. If we think only about codifiable knowledge, it is increasingly difficult to visualize any barriers to the easy diffusion of new ideas throughout the globe. As the pundits tell us, anything that can be written or digitized can easily be put on the Internet and be made freely available to the large (and still rapidly growing) fraction of the world's population with Internet access.

Tacit knowledge is clearly different. Because it is embedded in the minds of individuals and the routines of organizations, it doesn't move easily from place to place. Similarly, a base of tacit knowledge is frequently a pre-requisite for making use of any particular bit of codified knowledge.

The distinction between codifiable and tacit knowledge helps explain why technology doesn't completely erase the importance of proximity in transmitting ideas. Simply having access to codifiable information doesn't mean you have knowledge. Nobel Laureate Robert Lucas looked at the economic rationale for cities and concluded that, "if we postulate only the usual list of economic forces, cities should fly apart. The theory of production contains nothing to hold a city together. A city is simply a collection of factors of production: capital, people and land - and land is always far cheaper outside cities than inside. Why don't capital and people move outside, combining themselves with cheaper land and increasing profits?" (Lucas 1988, page 38) The answer is that knowledge spillovers from the human capital in cities provide higher productivity that holds cities together.

The work of economic historians points out clearly that different types of knowledge get created in different places, depending on a number of factors including social, institutional, and economic forces, and even historical accidents (Mokyr 1990). We are well aware of national differences in industrial development. For example, early in the industrial revolution, the British were responsible for an enormous number of advances, while later in the 19th and early in the 20th centuries, the United States pioneered a huge number of inventions and innovations, ranging from the McCormack reaper to the multidivisional corporation. Today, a principal trait that distinguishes the rich nations from the poor ones is vibrant, idea-creating industries that produce and sell increasingly sophisticated products in global markets.

Empirical data support the notion that knowledge creation tends to be quite localized. Studies of the patterns of patent activity in Europe, for example, find

that innovative activity, measured by new patents issued, is considerably more concentrated than economic activity (Caniels 1997). Audretsch and Feldman, who examined data on new product innovations in the U.S. found that they were most highly concentrated in a few regions in those industries in which new knowledge plays an important role (Audretsch 1998). One leading study found that cited predecessor patents were about five to ten times more likely to come from the same metropolitan area than were similar patents from a control group (Jaffe, Trachtenberg et al. 1993).

Despite the fact that knowledge flows most easily to nearby firms, economic benefits do not flow automatically to the regions where research occurs. To take advantage of academic research, a region also needs to have a local industry base that makes use of the ideas, otherwise they are likely to flow to other, established industry centers (Fogarty 1999).

3.2 Local and Regional Policies and Institutions Shape Knowledge-based Development

The most important job for economic policy is to create an institutional environment that supports technological change (Romer 1994).

What can regions, and particularly local governments in various regions, do to stimulate knowledge-based growth? Is the government that best befits the economy one that gradually withers away, or a strong one? Much economic theory gives the impression that governments are needed only when markets won't work, to address market failures, or provide public goods like fire protection, and to achieve purely social aims, like taking care of the poor and elderly. Governments that do more than the minimum, the conventional wisdom goes, sap the economy of its strength.

Knowledge creation is not purely the product of market forces. Non-market forces, particularly institutions can also influence what kinds of knowledge are created. A number of economists have begun to consider the role that different institutional arrangements play in economic development.

Economic historian Douglass North won the Nobel Prize in Economics in 1993 for his work on the role of institutions (broadly defined to include governments, culture, and a range of non-market organizations) in shaping the prospects for economic growth. North observes that in all of human history, successful, rapidly growing, wealth-creating economies have existed for only a few centuries. The story of most of our civilizations (and most of the Third World today) is one of social systems that only sporadically meet the basic needs of their populations, and which regularly fail to generate sustained economic progress (North 1990).

The problem with neoclassical theory, North argues, is that it fails to explain how successful economies come into being, and how they develop over time. Most societies throughout history have gotten stuck with a set of institutions that failed to evolve the kinds of beliefs, behaviors and practices that allowed the development of a modern economy. Modern societies not only have very different economies than did more primitive societies, but different, and far more complex sets of institutions as well.

Over time, the problems that societies face, change. Population growth, war, disease, technological change, and other factors change the optimal economic arrangements for any society. In the 18th century, economic activity was organized largely at the family and individual level. Extended families ran businesses, one's children provided old-age support, and most people worked for themselves. Absent institutional innovations like the private corporation, social security, and unemployment insurance, individuals would find it much more difficult to organize and participate in large scale economic activity than they do today.

A common interpretation of neoclassical economics is that that government actions that do more than specify property rights invariably hinder the efficient operation of markets. But if effective institutions play a central role in knowledge creation, this creates the potential for improving government policies as a way of promoting economic development.

Box 5 Principles for Action: How regional leaders can build the cornerstones of regional innovation:

1. Innovation is a team sport
2. Good information puts innovation on the regional agenda
3. Inform, connect and promote (Over and over again)
4. Think regionally, act regionally
5. Tear down walls between people
6. Hot ideas come from cool places
7. Learn from others, but create your own
8. Unleash the power of Networks
9. The job is never done
10. Anyone could create the "Next Big Thing"

(Collaborative Economics 1999)

Many important institutional innovations deal with the creation and diffusion of knowledge. Some of these institutions, like patents and copyright law, have relatively long histories. Universal public education is a relatively recent development. So too are public land grant universities, peer-reviewed academic research, and public-private research partnerships. As Paul Romer points out, there are many conceivable sets of institutional arrangements that can be developed to encourage the further development and deployment of economically valuable new ideas (Romer 1993b).

Not only are institutions important to the effective functioning of an economy at any point in time, institutions have to change *over time* to produce the incentives and rules required by new markets and technology. The ability of institutions to adapt to the changing economic situation, and to develop new rules and practices to guide transactions shapes the ability of economies to continue to progress.

North argues that it is this *adaptive* efficiency, the ability of economies and institutions to change over time to respond to successive new situations—and not static efficiency, the optimization of the allocation of resources at any given time—that is the critical factor shaping economic development. North explains:

Adaptive efficiency . . . is concerned with the kinds of rules that shape the way an economy evolves through time. It is also concerned with the willingness of a society to acquire knowledge and learning, to induce innovation, to undertake risk and creative activity of all sorts, as well as to resolve problems and bottlenecks of the society through time. We are far from knowing all the aspects of what makes for adaptive efficiency, but clearly the overall institutional structure plays a key role to the degree that the society and the economy will encourage the trials, experiments and innovations that we can characterize as adaptively efficient. The incentives embedded in the institutional framework direct the process of learning by doing and the development of tacit knowledge that will lead individuals in decision-making processes to evolve systems that are different from the ones that they had to begin with (North 1990, pp. 80-81).

Box 6: Building Regional Capacity for Innovation

1. Support and help mobilize facilitators—people, institutions and organizations. Build networks.
2. Invest in assets. The most important asset in a technology driven economy is people.
3. Seek to catalyze innovation and entrepreneurship.
4. Foster an innovative mindset and an entrepreneurial culture.

(Montana, Reamer et al. 2001)

Traditionally, economics focuses on allocative efficiency—the allocation of scarce goods and services among competing ends. The typical definition of allocative efficiency is “pareto optimality” (there exists no situation in which one person can be made better off without making someone else worse off). But efficiency in allocation doesn’t necessarily imply efficiency in adaptation.

One critical element in adaptive efficiency is the tolerance for new ideas. As Schumpeter observed, change often entails the creative destruction of the existing economic and political order. The willingness of societies to tolerate new ideas that challenge the current arrangements of business and government has varied over time, and still varies considerably among (and within) nations. In a historical sense, the openness of the West to new knowledge in the Renaissance and the Enlightenment produced the new ideas that led to the industrial revolution; the particular institutional arrangements of the United States (the Constitution, the interstate commerce clause) led to the development of a national economy. Similarly, among nations today, the relative openness to new ideas in some nations (Singapore and Taiwan for example) may have much to do with their recent economic success.

Perhaps most important, scholars recognize that the cultural and institutional differences between regions can play a decisive role in shaping the competitive success of industries. In a careful study examining the differences between nation's two largest high tech centers, AnnaLee Saxenian found that Silicon Valley's success and Route 128's stagnation can be traced to underlying differences in business cultures. She concludes:

Silicon Valley's experience shows that, paradoxically, regions offer an important source of competitive advantage even as production and markets become more global. . . . The widespread failure of science parks and other efforts by localities around the world to "grow the next Silicon Valley" underscores the limits of an approach that focuses solely on ensuring free flows of capital, labor and technology. Indeed, the main lesson of Silicon Valley is that it is the relationships between firms, not their simple presence that matters. The most effective arena for setting policies is at the regional level—the level of metropolitan or county government, or even the government of a small state (Saxenian 1994, page 31).

Governments have a crucial role to play in setting up the right structures for economies to evolve over time. Many of the most critical changes will deal with the incentives for knowledge creation. As technologies change and economies grow, our institutions will continue to need to devise new arrangements and solutions for economic problems, from allocating the electromagnetic spectrum to refining the law governing patents (Thurow 1999).

In an era of knowledge-based growth, regions need to develop local institutional arrangements--including government policies and the local business culture—to encourage knowledge creation. This will be a never-ending task. Over time, as technologies and business conditions change, institutional arrangements will need to change to provide the incentives and opportunities for different kinds of knowledge creation. Some of the practical steps regional leaders can take to assure that they recognize and encourage innovation are listed in Boxes 5 and 6. Those areas that are, to use Douglass North's term adaptively efficient, who most quickly and effectively respond to these changes, will be among the most prosperous.

4.0 Quality of Life and Competition

The growing importance of knowledge-creation as a driver in regional economic development signals a sea change in the aspects of place that are decisive to industry location. Quality of life plays a central role in determining what kind of workers live in an area. It does so by influencing the amenities (local public goods) that are available in certain places, as well as the distinctive consumption opportunities (local private goods), and also by influencing the access to other people who value these same characteristics.

What is quality of life? Why is it important to the economy? One view of the quality of life has been as a supplement to money income in our definition of personal and social well-being. Individuals in particular places get not only a money income (wages and salaries, for example), but they can also be thought of as getting a “second paycheck” in the form of the value of all of the other positive characteristics of the place in which they live, including especially environmental amenities (Whitelaw and Niemi 1989). Places that have amenities provide a higher real standard of living (first plus second paycheck) than others, and therefore are able attract workers. The growing importance of the quality of life is, according to many experts, a principal reason for sustained economic growth in the Pacific Northwest (Power 1995).

Traditional models of economic development have pictured a world populated by relatively mobile firms and capitals and relatively homogenous but immobile labor: places (especially states and regions within the United States) had relatively similar endowments of trained workers, but firms and capital were relatively free to pick and choose their locations based on the minimizing their production costs. In this kind of a world, it makes sense for places to compete for firms and investment as a way of increasing the demand for local labor, and thereby improving local employment and incomes. The most common economic policies, therefore, focus on attracting firms to places, assuming that labor is (or will be) equally available everywhere.

In the knowledge-based economy, the tables are turned. Talented workers, those with the specialized skill and knowledge needed to create new products and technology, are in short supply. Many of these workers are among the most geographically-mobile segments of the population: those with relatively high levels of educational attainment, higher than average incomes, and especially those in the 25-34-year cohort. To the extent that these persons choose to live in some regions and not others, those regions will have a systematically higher level of knowledge-creation activity. Firms seeking access to skilled knowledge workers will be drawn to such places.

As a consequence of this shift, a new set of potential development strategies are arising for those seeking knowledge-based growth. Places that consciously seek to attract firms can do so by establishing conditions that attract and retain workers. Already, surveys of business location preferences suggest that the requisite pool of highly skilled technical and managerial professionals can be found only in those places that have a sufficiently high quality of life and amenities (Gottlieb 1994).

There is strong evidence that the fastest growing segments of the technology industry are especially sensitive to the availability of talented workers, and that in turn these workers are attracted to region's well endowed with quality of life aspects, particularly natural, recreational, and lifestyle amenities (Florida 2000). Knowledge workers prefer places with a diverse range of outdoor recreational activities (e.g., rowing, sailing, cycling, rock climbing) and associated lifestyle amenities. The availability of job and career opportunities is a necessary but insufficient condition to attract the young knowledge workers. Leading high technology regions are also high amenity regions with high levels of amenities and environmental quality. Austin, Texas; Seattle, Washington; the San Francisco Bay area; the greater Boston region; and Washington, DC score consistently high across virtually every measure of natural amenities, lifestyle amenities, and overall environmental quality. The kinds of investments that the public sector makes in schools, parks, museums, theaters, festivals and similar cultural and entertainment facilities can attract these workers; in addition, those places that have developed specialized or distinctive amenity assets, like a nationally-recognized local music scene, outstanding outdoor recreation opportunities and easy access to natural beauty, can further develop their attractiveness to knowledge workers. The local public goods—amenities available to the residents of a particular region—are an increasingly important economic differentiator.

But not all of the important differences among places or regions are the products of variations in public investment. Many private consumption opportunities are highly localized. These local private goods, like distinctive restaurants, bookstores, specialty shops, clubs, are a product of differences in the scale and tastes of different areas. Although the historic economic advantage of larger metropolitan areas has stemmed from their relatively higher productive efficiency, it seems likely that in the future larger metropolitan areas will be favored because they provide consumers with a richer array of possible consumption opportunities (Glaeser 2000).

The variations in quality of life and consumption patterns among places may also play a role in shaping the kinds of businesses that get created. Recreation-related businesses (producers of snowmobiles, whitewater kayaks, windsurfing gear, for example) show a strong tendency to develop in places where these activities are an important part of the local quality of life (Cortright 2002).

Not only do the choices of public amenities and private goods vary from place to place. So, too, do the characteristics of the population. This might be unimportant if the entire population were composed of autonomous individuals; but in reality, most, though not all of any region's individuals are members of households. In an earlier era, the primacy of men in the labor force (particularly in professions) and in earning incomes for households meant that the career aspirations of the male dictated the locational decisions of the household. But today, women's participation in the labor force has risen sharply, particularly among women with a professional degree. In addition, for a variety of reasons, more highly educated persons are very likely to have similarly educated mates. This means that the labor market is shaped not by the preferences of single individuals, but by the joint preferences (and dual career aspirations) of two individuals. Couples in which both husband and wife have at least a college education are increasingly, and disproportionately, located in large metropolitan areas (Costa and Kahn 2000).

An important element in the economic dynamism of particular places is their institutional receptivity to new ideas and new ventures (a point we describe in the previous section). The diversity of the local population and their attitudes towards unusual behavior may be one important indicator of whether a place has the kind of circumstances that will attract and retain a creative population, and encourage it to flourish. One examination of the relationship between innovation and population diversity found a significant positive correlation between measures of population diversity—the fraction of the population that was gay, or artists and writers—and the likelihood that the region was among one of the nation’s leading technology centers (Florida 2001).

It seems highly likely that the importance of quality of life will increase in the knowledge-based economy. And the demand for quality of life attributes increases with income, and income levels are expected to continue to rise. At the same time, increasing incomes increase the value of consumers time, putting a premium on quality of life amenities that are close at hand and convenient (Romer 2000).

For those concerned about local prosperity in a knowledge-based economy, developing and maintaining a distinctive quality of life is likely to be an essential component their development strategy. Places with a poor or deteriorating quality of life will find it difficult to attract workers and firms, will be weak at innovation, and will find themselves falling further behind. In contrast, those places that develop a distinctive and improving quality of life will be at an advantage in assembling and retaining the knowledge workers on which prosperity increasingly depends.

5.0 Strategies for Prosperity

In the 21st century, it seems clear that a new set of economic strategies will be needed to achieve prosperity. In the years ahead, creating knowledge will be the key driver behind economic growth, both for the economy as a whole, and for particular areas. Institutions and public policies will play important roles in creating the circumstances for innovation and the diffusion of knowledge.

For region's seeking prosperity, there appear to be five broad strategies:

- Economic strategies should focus on creating knowledge, not just in universities and laboratories, but by businesses as well.
- States and communities are not powerless to influence their economic destiny. Positive feedbacks and chaotic development patterns of knowledge-based growth mean that some actions will have big paybacks. Even so, it will be difficult or even impossible to know what will work.
- The path dependent quality of growth means opportunities for future growth will depend, in large part, on the current local base of knowledge and expertise, and communities should seek to build on this in their strategies.
- Ideas of all kinds, large and small, play a role in economic growth. In many ways, structuring businesses to encourage innovation by front-line workers is as important to the knowledge economy as undertaking scientific research.

5.1 Creating Knowledge is Central To Economic Development

The clearest lesson about the knowledge economy is that those who have more knowledge, and those who are good at creating new knowledge will be in the best position to prosper. Smart people, smart firms, and smart places will flourish. Others will struggle.

There are a variety of things one can do to strengthen one's knowledge base and ability to create knowledge. (As the themes articulated in Box 7 illustrate); learning is first step in a knowledge-based economic strategy. Learning can take many forms: research and development activities and education and skill development are the most obvious steps.

Places that invest more in research and development seem generally to be more prosperous. A simple reading of the lessons of knowledge-based growth might suggest we ought to work just at creating more knowledge. Much of the thinking about the role of research, particularly basic research, has reflected a linear model of technological change (Malecki 1997). Basic research (in universities) produces new scientific insights that in turn lead to applied research that refine the idea; development involves reducing the refinements to practical application, and then they are diffused into widespread use. For example, insights from sub-atomic physics eventually enable makers of computer disks to fit information ever more densely on magnetic disks. Many in economic development believe in

a geographic parallel to the linear model—that new industries invariably arise from nearby scientific research (Goldberg 1999).

But the relationship between science and technology is actually not one-Any proposal for sustaining or increasing the rate of growth must take careful account of these interactions [between the private marketplace and academic research] and must not treat science as if it operated in isolation. In particular, we must not presume that devoting more resources to the basic research end of the process will automatically lead to economic gains (Romer 1998).

Box 7: Becoming a New Economy Leader

- Learning: Improve your knowledge base
- Linking: Build telecommunications tools
- Leading: Promote creativity and strategic thinking
- Living: Cultivate communities that attract talent

(Arizona Partnership for a New Economy 2000)

But scientific progress is not uni- directional, nor is it as passive as the linear model makes it seem. Scientific insights frequently stem from the need to solve practical problems or explain the observations gained from applying a particular technology in practice. As Romer has pointed out, the science of thermodynamics emerged from the learning associated with the tinkering inventors did to steam engines in the 18th and 19th Centuries. If you believe in the linear model, it should have happened the other way around: scientists discovering the principles of thermodynamics and then inventors using this knowledge to build steam engines (Romer 1998).

The critical lesson is that economically valuable research doesn't happen just inside universities or dedicated research laboratories. Businesses large and small are the source of many important innovations. In addition, the activities of businesses tend to lock the economic benefits of new knowledge creation into particular places.

One of the most robust and basic findings of recent research about economic and income growth is the connection between education, higher productivity, and higher worker earnings. The returns to investment in human capital—improvements in skill and knowledge—have been greater than the returns to physical capital (Summers 2000). There has been a dramatic change in just the past few years. In the 1970s, the typical male college graduate's wage was about 33 percent more than that of the typical male high school graduate. By the early 1990s, the college graduate made 74 percent more (Kodrzycki 1996). The differential has become especially pronounced for young workers. Among males aged 25 to 34 years old, those with a college education used to earn about 15 percent more than their peers with only a high school diploma. Today, the differential has tripled, to a 55 percent premium for a college degree (Murnane 1996).

What is true for individuals is true for regions as well. The better educated you are, the higher your income and the faster it rises. A study of average educational attainment and income growth in US metropolitan areas found that those areas with the highest levels of education experienced almost double the level of income growth as those areas with the lowest levels of education (Gottlieb and Fogarty 1999).

The many practical problems that workers and businesses face and solve each day are a source of knowledge creation. Businesses and places that provide good environments for understanding problems and creating knowledge are just as important to the new economy as are those conducting scientific research. New Growth Theory suggests both that we should bolster basic research, and that we should do all we can to stimulate application of knowledge and learning by doing.

Box 8: Four Pillars of a Policy to Support a New Economy

1. Investment in new economic foundations, specifically education, training and scientific and technological research.
2. Creation of an open and flexible regulatory and trade regime that supports growth and innovation, including policies that support the IT revolution.
3. Development of policies to enable American workers to have the tools they need to navigate, adapt and prosper in a continually changing economic environment.
4. Reinvention—and digitization—of government to make it fast, responsive and flexible.

(Atkinson and Court 1998)

5.2. Strategic Opportunities Exist to Influence Economic Growth

The insights afforded by neoclassical economic theory offered very limited sets of policy advice to states and communities seeking to influence their economic destinies. Aside from making sure that private property was secure and that taxes were not too high to discourage productivity activity, about all economists advised governments to do was encourage “more schooling and more saving” (Romer 1992). In the traditional view, geographic patterns of economic activity are driven, in a deterministic way, by the distribution of natural resources and the efficient operation of markets.

In contrast, if we assume that knowledge creation is central to growth—that it is characterized by increasing returns, and leads to path dependent growth processes—small events at key times can reshape the direction of economic growth and the geographic pattern of economic activity. In this view, economic growth is not deterministic, but is chaotic, unpredictable and shaped by the choices made by economic actors.

knowledge spillovers shape these chaotic patterns of development. If the spillovers from knowledge creation happen more quickly within countries than among them, this produces a situation in which countries can create a comparative advantage for particular industries (Grossman and Helpman 1990). Countries, regions, or cities that are among the first to develop a particular industry may benefit from the positive feedbacks or increasing returns that encourage the industry to become more concentrated in a particular location, resulting in an enduring pattern of economic activity.

Many economists will admit that small intentional actions can have dramatic long run effects. The creation stories of Silicon Valley, one of the most important knowledge-creating industrial agglomerations, generally highlight the importance of one man, Fred Terman, Dean of the Electrical Engineering School at Stanford in the 1930s, in encouraging and supporting the formation of new firms. While they may be comfortable acknowledging that a university official might consciously do something that would change the direction of the local economy in a favorable way, economists are almost universally skeptical of the public sector's ability to make similar decisions (Krugman 1994).

Whether policymakers are always savvy enough to make similar good decisions is an open question. Theorists bristle at the notion that New Growth Theory can be used to justify substituting political decisions for those of the marketplace. While some policies (big technology projects linking the breeder reactor and coal gasification for example) have been colossal failures, some government programs have produced enormous benefits (major advances in aerospace, computers, semiconductors and the Internet were all fueled by federal research spending and defense procurement).

5.3 Every Region has Different Opportunities

One of the paradoxes of the global economy is the increasing importance of the unique attributes of local communities. Local strengths are not only still important, but perhaps more important in a global economy.

Box 9 Reshaping the Economic Environment

- Create and apply knowledge to work
- Foster an entrepreneurial culture and encourage venture capital formation
- Nurture clusters and facilitate business networks
- Reform the tax structure

(Bonnett 2000)

As more and more knowledge is codified (written down or digitized) and as advancing technologies like the Internet ease the dissemination of this codified knowledge throughout the world, businesses that rely on such knowledge face more competition. Any type of knowledge that is ubiquitous is unlikely to be a source of competitive advantage for a business, particularly one located in a high cost area. New knowledge, tacit knowledge, and ideas that are hard to

communicate or imitate are a much more durable source of competitive advantage (Maskell 1998).

Underlying regional differences in behavior and culture shape the particular kinds of businesses that develop in a particular region. The English passion for gardening and the Italian love of motor-racing have helped trigger and sustain the development of world class industry clusters in both of those nations (Porter 1990). The relatively higher concentration of “beautiful people” in southern California and avaricious business people in New York City explain, in part, the development of the film and fashion industries in the former and finance in the latter (Krugman 1999). Many of the best opportunities to develop sustainable businesses in an increasingly global market may emphasize the unique qualities of the place in which it is produced (Kilkenny 1999). While these regional

Box 10 Economic Benchmarks for Public and Private Decisionmakers

For 15 years, the Development Report Card for the States (DRC) has provided an annual assessment of each state's economy and potential for future growth. Based upon 70 data measures, the DRC's framework consists of two key ideas:

- The goal of any state development policy is increased well-being for all its citizens; and
- The success of a state's economy in delivering a more widely shared standard of living depends upon the vitality of its businesses and the strength of its physical infrastructure, amenities, natural and human capital, financial resources, and innovation assets.

Key Findings for 2001

Quality Development

The evidence shows that the quality—not just the quantity—of economic growth is an important factor in a state's economic success or failure.

Employee Investment and Performance

States with companies that are taking the high road to development and investing in human resources—high salaries, wage increases, and health benefits—are among the highest performing states overall.

Technology and Investment

States that continue to attract venture capital and support a vibrant technology sector outperform states that do not.

Natural Resource Management and Performance

Counterintuitive to most business assumptions, investment in conservation and natural resource efficiency and management are compatible with economic performance.

2001 Development Report Card of the States

(Corporation for Enterprise Development 2001)

variations in the environment are important for shaping local development, they also play a key role in overall economic progress. The ecological niches created by regional variety are important to reinforcing the processes of trial and experimentation that drive economic growth (Maskell and Malmberg 1999).

As Douglas North points out, the development opportunities of any region are constrained, not just by its economic situation, but by its institutions, its political system, its belief systems, and its past history (North 1995). This works against one-size-fits-all prescriptions for economic development. The set of feasible and effective policies and economic opportunities available to one economy are likely to be very different from those in another. One important role for planning should be to identify existing and emerging knowledge strengths on which future development is likely to build.

5.4 Everyone Can Create Knowledge

. . . under the new system, firms will increasingly take advantage of each person's innate curiosity and willingness to experiment. . . every worker in an organization, from top to bottom, can become a "knowledge" worker if given the opportunity to do so (Romer 1993a, p. 72).

While we tend to view economic progress as the product of the big scientific breakthroughs—the wheel, the steam engine, and the computer chip—it is equally true that millions of small innovations also drive economic growth. Many productivity improvements come from the application of fairly simple ideas in bold or novel ways: Federal Express builds an overnight parcel service, Frito-Lay develops an enormously efficient distribution system, Toyota slashes inventory and raises quality by using lean production and just-in-time deliveries. Most of the economic gains from technological breakthroughs (steam engines, electricity, or lasers) are realized only decades after their discovery or initial demonstration, and only after a considerable amount of further refinement, innovation, and complementary changes in the organization of economic activity to realize the full benefits of the technology.

The scope for the improvement of products and processes is enormous. As Paul Romer pointed out, there are far more useful ideas and inventions to be discovered than human beings will ever be able to conceive, much less produce. A key element of economic progress, underscored by the evolutionary theorists, is having an economic system that generates the maximum number of trials or experiments that lead to the discovery of economically valuable new ideas. Limiting the production of new ideas to just a small fraction of a company's employees necessarily limits the amount of experimentation and knowledge creation that can occur.

One result of this observation is that many private companies are explicitly restructuring their management systems to give all workers, including front-line workers a broader array of responsibility, including responsibility for the development of new ideas. Case studies of the automobile industry underscored the importance of worker led teams and continuous innovation and quality improvement, practices pioneered in Japan and now emulated by the best North American manufacturers (Womack, Jones et al. 1990). Careful quantitative

studies of new forms of work organization tend to confirm the role of high performance work organization in raising productivity (Black and Lynch 2000).

5.5 Lessons for Policy Makers

A number of states and metropolitan areas and a wide range of policy experts have been developing strategic planning processes to comprehensively address the issues raised by the emergence of the knowledge-based economy. Our examination of their work suggests that there are a number of general principles that should guide decision-makers as they develop strategies for their communities. These principles are summarized below.

Explicit Goal: Improved standard of living. Economic strategy begins, nearly all observers and practitioners agree, with a clear statement of objective. In a knowledge-based economy, this objective is to improve the standard of living of the region's residents. In this sense, standard of living encompasses three components: the level of income, the distribution of income, and the quality of life. An improved standard of living is measured in part by increases in real per capita income, for a broad range of groups in a region, and in maintaining and improving the quality of life of an area. The standard of living does not improve if increases in income are offset by a deteriorating quality of life.

Fact-Based: Understanding of regional economy. Economic strategies need to be driven by a thorough analysis of a region's economic position. Not only as the external environment changes by globalization and technological progress, but region's must have a deep awareness of their particular strengths and weaknesses. Relying on an inherited conventional wisdom about the local economy and its advantages is particularly dangerous in a fast changing world.

Widely-Accepted: Regional consensus on strategy. In order to be successful, economic strategies need to have a wide-array of backers and supporters. The scope of actions needed to secure a viable economy today are quite broad, touching on education, regulation, planning, and infrastructure. Economic development is no longer the narrow technical province of a special purpose agency.

Cluster Driven: Organize by cluster. Strategies for economic development need to explicitly address the role of each of a region's different economic clusters, and more than that, to develop ongoing organizational relationships with each cluster to help build its competitiveness.

Innovation Focused: Emphasize innovation and knowledge creation. In a knowledge-based economy the best indicator of long-term success is the continuing ability to create knowledge. The focus of strategies, programs, and investments needs to shift to emphasizing how a region—and its firms and workers—become more innovative. Attracting investment and “creating jobs” are ultimately secondary to expanding innovation.

Authentic: Tailored to the unique needs and values of the region. In a knowledge-based economy, each region will have a different set of development opportunities. Successful strategies will reflect variations in opportunity. One-size fits all or generic strategic will miss many of the best chances to grow the local economy.

Forward-Looking: Geared to the economy as it will be, not as it was. The knowledge-based economy is one of constant change; the temptation to repeat past successes or copy the current strategies of competitors may miss the fact that the future competitive environment will be different.

Sustainable: Leading to enduring - not temporary - prosperity and quality of life. Because quality of life is an intrinsic part of economic prosperity, and a critical ingredient in attracting and retaining knowledge workers, economic strategies that are not sustainable, that deplete finite resources, may ultimately make the community worse off.

Measurable: With clear benchmarks to gauge progress. Effective economic strategies incorporate measurable benchmarks to monitor performance over time, and to provide feedback to decision-makers about the effectiveness of a strategy.

References

- Arthur, W. B. (1987). "Competing Technologies, Increasing Returns and Lock-in by Historical Events." Economic Journal **99**: 116-131.
- Audretsch, D. B. (1998). "Agglomeration and the location of innovative activity." Oxford Review of Economic Policy **14** (2): 18-30.
- Black, S. E. and L. M. Lynch (2000). "What's Driving the New Economy: The Benefits of Workplace Innovation." NBER Working Paper **7479**.
- Brynjolfsson, E. and L. M. Hitt (1999). "Beyond Computation: Information Technology, Organizational Transformation and Business Performance." Journal of Economic Perspectives **14** (4): 23-48.
- Cairncross, F. (1997). The Death of Distance: How the Communications Revolution Will Change Our Lives. Cambridge, MA, Harvard Business School Press.
- Caniels, M. C. J. (1996). Regional Differences in Technology: Theory and Empirics. Maastricht, MERIT (May, 1996).
- Caniels, M. C. J. (1997). The Geographic Distribution of Patents and Value Added Across European Regions. Maastricht, Maastricht Economic Research Institute on Innovation and Technology (August, 1997) [http://meritbbs.unimaas.nl/rmpdf/rm98_004.pdf].
- Cortright, J. (2002). "The Economic Importance of Being Different: Regional Variations in Tastes, Increasing Returns and the Dynamics of Development." Economic Development Quarterly **16** (1): 3-16.
- Costa, D. L. and M. Kahn (2000). "Power Couples: Changes in the Locational Choice of the College Educated, 1940-1990." Quarterly Journal of Economics **115** (4): 1287-1316.
- David, P. A. (1985). "Clio and the economics of QWERTY." AEA Papers and Proceedings **75** (2): 332.
- David, P. A. (1997). Path Dependence and the Quest for Historical Economics: One More Chorus of the Ballad of QWERTY. Oxford, University of Oxford (November, 1997).
- Davis, S., J. Haltiwanger, et al. (1996). Job Creation and Destruction. Cambridge, MA, Massachusetts Institute of Technology Press.
- Florida, R. (2000). Competing in the Age of Talent: Quality of Place and the New Economy. Pittsburgh, Carnegie Mellon University.
- Florida, R. (2001). Technology and Tolerance: The Importance of Diversity to High-Technology Growth. Washington, DC, Brookings Institution (June 5, 2001) [<http://www.brookings.edu/es/urban/techtol.pdf>].
- Fogarty, M. (1999). Why Older Region's Can't Generalize From Route 128 and Silicon Valley: University-Industry Relationships and Regional Innovation Systems. Center for Regional Economic Issues, Case Western Reserve University (March 9, 1999.).

- Franko, L. G. (1991). *Global Corporate Competition: Is the large American Firm and Endangered Species?* Business Horizons.
- Glaeser, E. L. (2000). "Demand for Density? The Functions of the City in the 21st Century." The Brookings Review **18** (3): 10-13.
- Goldberg, C. (1999). "Across the US Universities are Fueling High Tech Booms". New York Times. New York: (October 8, 1999) A1
- Gottlieb, P. D. (1994). "Amenities as an Economic Development Tool: Is there Enough Evidence?" Economic Development Quarterly **8** (3): 270-285.
- Gottlieb, P. D. and M. Fogarty (1999). Educational Attainment and Metropolitan Growth. Cleveland, Weatherhead School of Management (July, 1999) [<http://weatherhead.cwru.edu/rei>].
- Greenspan, A. (2000). Remarks by Chairman Alan Greenspan: (April 27, 2000) [<http://www.federalreserve.gov/boarddocs/speeches/2000/20000427.htm>].
- Grossman, G. and E. Helpman (1990). "Comparative advantage and long run growth." The American Economic Review **80** (4): 796.
- Jaffe, A. B., M. Trachtenberg, et al. (1993). "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations." Quarterly Journal of Economics **108** (3): 577.
- Kantor, R. M. (1995). World Class: Thriving Locally in the Global Economy. New York, Simon & Schuster.
- Kilkenny, M. (1999). New economic geography for low density places: Insights from Kaldor and Lancaster. Conceptual Foundations of Economic Research in Rural Studies, Corvallis, OR (January, 1999), Western Rural Development Center
- Kodrzycki, Y. K. (1996). "Labor Markets and Earnings Inequality: A Status Report." New England Economic Review (May/June 1996): 11-25.
- Krugman, P. (1991a). Geography and Trade. Cambridge, The MIT Press.
- Krugman, P. (1991b). "Increasing Returns and Economic Geography." Journal of Political Economy **99** (31): 483.
- Krugman, P. (1994). Peddling Prosperity: Economic Sense and Nonsense in the Age of Diminished Expectations. New York, W.W. Norton.
- Krugman, P. (1999). Some Chaotic Thoughts on Regional Dynamics: (March 10, 1999) [<http://web.mit.edu/krugman/www/temin.html>].
- Lucas, R. E. (1988). "On the Mechanics of Economic Development." Journal of Monetary Economics **22**: 3.
- Malecki, E. J. (1997). Technology and Economic Development. Essex, Addison Wesley Longman.
- Maskell, P. (1998). Globalization and Industrial Competitiveness: The Process and Consequences of Ubiquitification. Making Connections: Technological Learning and Regional Economic Change. E. J. Malecki and P. Oinas. Aldershot, Ashgate Publishing: 35-59.

- Maskell, P. and A. Malmberg (1999). "Localized Learning and Industrial Competiveness." Cambridge Journal of Economics **23** (2): 167-185.
- Mokyr, J. (1990). The Lever of Riches: Technical Creativity and Economic Progress. New York, Oxford University Press.
- Murnane, R. J. (1996). "Demand and Supply Responses to Rising College Wage Premiums: Discussion." New England Economic Review (May/June 1996): 136-138.
- North, D. C. (1990). Institutions, Institutional Change and Economic Performance. Cambridge, Cambridge University Press.
- North, D. C. (1995). "The Adam Smith Address: Economic Theory in a Dynamic Economic World." Business Economics: 7.
- Ohmae, K. (1996). The End of the Nation State: The Rise of Regional Economies. New York, The Free Press.
- Peters, T. (1987). Thriving on Chaos: Handbook for a Management Revolution. New York, Knopf.
- Pisarski, Alan (1999). Testimony of Alan E. Pisarski. House Subcommittee on Ground Transportation, Washington, DC (February 3, 1999), [<http://www.house.gov/transportation/ground/02-03-99/pisarski.htm>].
- Porter, M. E. (1990). The Competitive Advantage of Nations. New York, Free Press.
- Porter, M. E. (1998). "Clusters and the New Economics of Competition." Harvard Business Review: 77-90.
- Power, T., et al, (1995). Economic Well-Being and Environmental Protection in the Pacific Northwest: A Consensus Report by Pacific Northwest Economists. Bozeman, MT, University of Montana: 18.
- Romer, P. M. (1992). "Two strategies for economic development: using ideas and producing ideas." Proceedings of the World Bank Annual Conference on Development Economics: 63.
- Romer, P. M. (1993a). Ideas and things: The concept of production is being retooled (The Future Surveyed: 150 Economist Years). The Economist: (September 11, 1993) F70(3).
- Romer, P. M. (1993b). "Implementing a National Technology Strategy with Self-Organizing Industry Investment Boards." Brookings Papers on Economic Activity: Microeconomics **2**: 345.
- Romer, P. M. (1994). "Beyond Classical and Keynesian Macroeconomic Policy." Policy Options **15** (July-August, 1994): 15-21.
- Romer, P. M. (1998). "Innovation: The New Pump of Growth." Blueprint: Ideas for a New Century (Winter, 1998).
- Romer, P. M. (2000). Time: It Really is Money. Information Week: (September 11, 2000) 396.
- Saxenian, A. (1994). "Lessons from Silicon Valley." Technology Review: 43.

- Schumpeter, J. A. (1934). The Theory of Economic Development. Oxford, Oxford University Press.
- Summers, L. (2000). The New Wealth of Nations: [<http://www.treas.gov/press/releases/ps617.htm>].
- Thurow, L. (1999). Building Wealth: The New Rules for Individuals, Companies, and Nations in the Knowledge-Based Economy. New York, Harper Collins.
- Whitelaw, W. E. and E. G. Niemi (1989). "The Greening of the Economy." Old Oregon **68** (3): 26-27.
- Womack, J. P., D. Jones, et al. (1990). The machine that changed the world: the story of lean production, Harper Perennial.