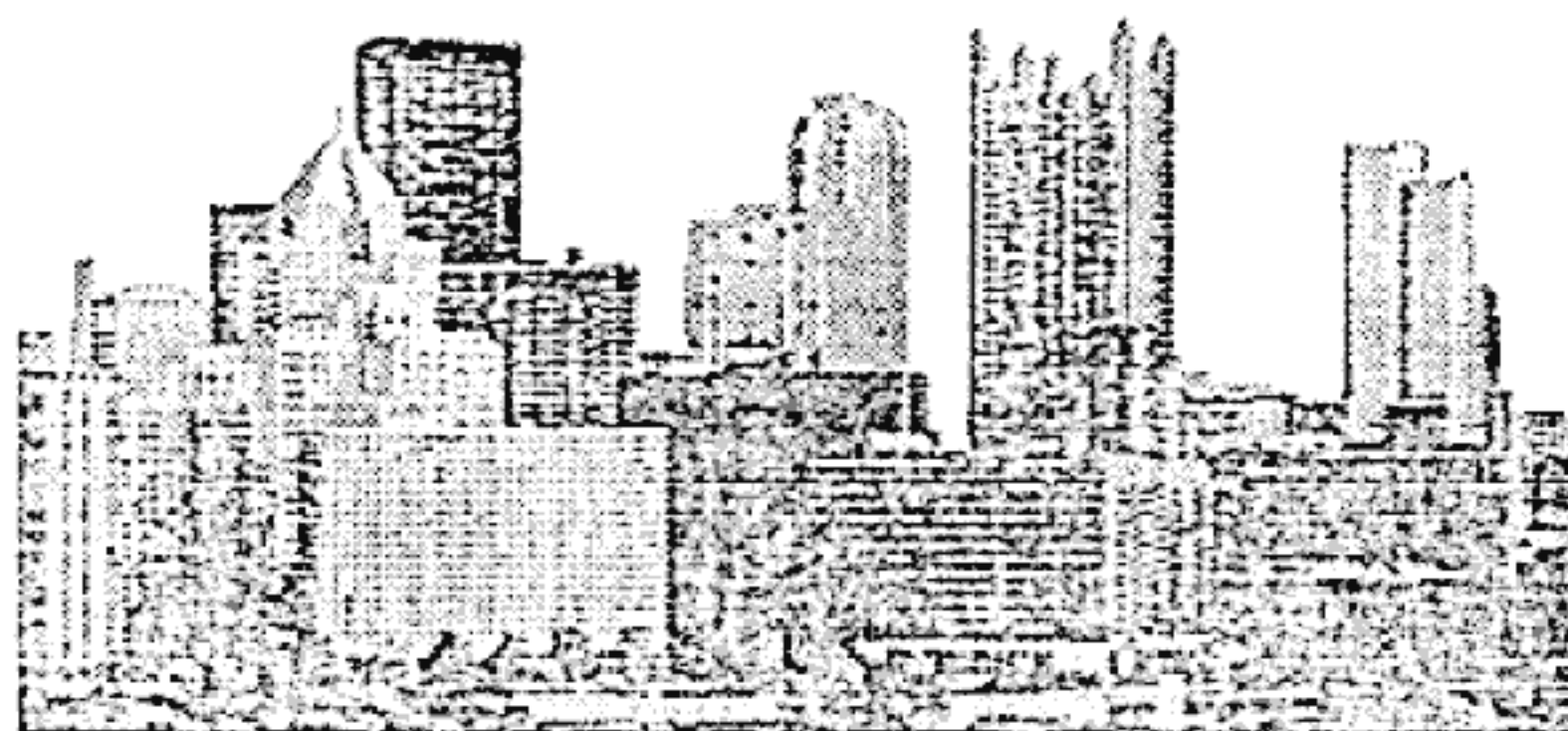


Linking the Environment to the New Competitiveness: Strategic Directions for the Pittsburgh Region



**A Report by the Sustainable Economic Development Project
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Introduction

Chapter 1 : Introduction

The plant manager of a Pittsburgh steel processing plant surveys his plant floor. The production equipment, most of which is at least forty years old, is working at maximum capacity, seven days a week twenty-four hours a day. The equipment uses water as a coolant in the production process and then discharges it, with a fresh batch of water used for the next round of production. Periodically, a plant employee tests the discharge to ensure that it contains no effluents. Could modern equipment that recirculates the water increase his productivity while also increasing his pollution prevention capabilities?

An early April 1995 article in the *Pittsburgh Post-Gazette* reported that the Pittsburgh area is now producing its maximum allowable amount of auto and industrial emissions. However, state and federal environmental agencies, forecasting no growth for the Pittsburgh region, will not require additional emissions controls. A second article on April 28, 1995, noted that: "Area employment expands at a fourth of US pace...replace "sluggish" with "anemic" and you've described the pace of job growth in the region...mark(ing) the fourth straight year local employment grew by less than 1 percent...Economists interpreted the downward revision as evidence that the region's still suffering from the rapid decline in manufacturing and the more recent restructuring in the health-care industry."¹

In recent years, however, a growing number of world class companies have developed win-win strategies using environmental improvement to achieve production gains and increase profits. Previously, experts have regarded the relationship between environmental issues and competitiveness as a zero-sum game, pitting economic growth against environmental improvements. A recent report by the Business Council for Sustainable Development highlights leading international companies who, over the past decade or so, have incorporated as best business practices those integrating environmental and economic goals. This fusion of goals requires a supportive and dynamic regional system, as well as economic instruments. These instruments are based on efficiency, flexibility of response, confidence in a stable regulatory environment, transparency of compliance, and gradual introduction of a level playing field through a "polluter pays principle."²

This study addresses three key questions. What is the link between the environment and competitiveness in comparable regions? What is the link between the environment and competitiveness in firms? How can Pittsburgh link the environment and economic growth?

To address these questions, our project focused on three key tasks. First, members of the project team benchmarked the Pittsburgh region against comparable national and international regions pursuing environmental strategies. Second, we conducted a national survey to identify corporate environmental best practices. Third, we compared the economic and environmental performance of manufacturing in major US metropolitan areas.

Our conclusion is that both firms and regions are developing new "win-win" approaches linking the environment to competitiveness. Companies are developing new and innovative approaches to pollution prevention, partnering with their suppliers in strategies to improve both productivity and environmental performance. They are pursuing strategies to move toward zero emissions, zero defects and zero inventory. Regions like Chattanooga, Tennessee have made the environment an integral part of their growth agenda. Others, like Kitakyushu, Japan, have developed integrated competitive and sustainable strategies.

¹ Massey, Steve. "Job Growth Slows" in the *Pittsburgh Post Gazette*. April 28, 1995. D1.

² Schmidheiny, Stephan. *Changing Course*. The MIT Press, Cambridge, Massachusetts, 1992.

Based on our analyses, we see the emergence of a New Competitiveness strategy in firms and regions. This vision includes the recognition that the environment is an integral factor of the region's economic competitiveness. The strategy is realized through reinvestment in the local economy and values the "place" itself as a source of competitive advantage.

From our findings we offer the following strategic recommendations for our region.

- **Environment as a source of competitive advantage**

Environmental remediation cannot succeed in and of itself as the engine of growth for the Pittsburgh region. Environmental gains must be part of a broader strategy for economic growth.

- **Promote environmental improvement through pursuit of Win-Win opportunities**

The industrial base needs to seek out win-win opportunities that promote environmental performance and economic growth. Currently, the manufacturing sector is not competing well in either the environmental or economic dimension.

- **Connect the region's environmental technology to the manufacturing base**

A gap exists between the region's base of environmental technology expertise and the manufacturing base. Though there are a large number of environmental companies in the Pittsburgh region, they have scant interaction with the general manufacturers here. The region must harness this local source of expertise and resources if the manufacturing sector is to adopt win-win improved environmental and economic strategies.

- **Encourage adoption and diffusion of "best corporate environmental practices"**

Pittsburgh's manufacturing firms lag behind national companies in adopting "best corporate environmental practices." These best practices include the use of production process improvements as a part of their environmental strategy and the use of Total Quality Environmental Management (TQEM) programs. However, Pittsburgh may be able to build on an existing core of innovative local firms who are currently beginning to incorporate such practices into their business strategies.

- **Link the environment to Pittsburgh's strategy for competitiveness. Develop an integrated approach to environmental renewal**

The various Pittsburgh economic and community development organizations need a shared vision of growth for the region. Local development groups are very sophisticated and knowledgeable and, if their energies are harnessed together, can spark competitiveness.

Regions, Environment, and the New Competitiveness

Chapter 2 : Regions, Environment, and the New Competitiveness

A new agenda for regional competitiveness is emerging. Traditionally, economic growth and the environment were seen as adversaries. Regions across the world are now realizing that economic growth and environmental improvements can be complementary. Trends in the global economy are defining new standards for competitiveness. There is a shift from mass production to high performance production as a source of competitive advantage. Knowledge and satisfying of customers' needs are the sources of competitive advantages. These changes are not occurring exclusively in the private sector; regional strategies are also changing. They are becoming more supportive and are encouraging all sectors of society to share a common vision. Regions are asking for the participation of business and communities in the design and decision-making process.

In the past, regional economic development had an industrial focus. Regions competed with each other by offering lower taxes, cheap labor and less stringent environmental regulations. The objective was to offer conditions that would allow firms to reduce their production costs, even when that meant compromising the integrity of the environment. This paradigm is changing.

A critical dimension in the emerging economic development paradigm is the linkage of economic and environmental objectives. Remediation and cleanup have become starting points for recognizing the environment as a source of competitiveness. Some regions actively encourage firms to adopt environmentally friendly technologies, encouraging research consortia and market-oriented incentives rather than relying on command and control or waste reduction regulations.

These changes are redefining development in terms of sustainability. Though the meaning of the word "sustainability" is very ambiguous, the definition provided by Nobel Prize winning economist Robert Solow is useful. "A concern for sustainability implies a bias toward investment ... it means just enough investment to maintain the broad stock of capital intact."³ This definition involves three ideas. First, it implies a sense of responsibility for future generations by preserving for the future a certain level of well-being. Second, it allows for trade-offs and substitutions among resources: the environment and natural resources by themselves are not the only means to economic welfare, and therefore it is simplistic to preserve them for their own sake. Third, it implies there will be depletion of resources, yet depletion can be minimized through efficient production processes and technological innovation.

A paradigm or new model for regional competitiveness is clearly emerging – one where competition and environmental sustainability go hand-in-hand. This Competitive and Sustainable Region model stresses cooperation and interdependence among the different economic agents and stakeholders. There is an overlapping of interests and common objectives, as well as an increasing presence of such institutions as partnerships and consortia aimed at searching for solutions to common problems. In this new setting the government has a catalytic role. It is no longer only a regulatory institution focused on designing policies to limit the actions of other agents. Rather, it supports the community and private sector, while promoting partnerships among the various actors.

In this emerging model, competitiveness relies on knowledge. High-performance production practices maximize the value of human knowledge and enable firms to meet customers' needs. The emphasis is on human capital. Workers are encouraged to take initiative and to work in groups. Line

³ Solow, Robert, 1992. *An Almost Practical Step Toward Sustainability*. Resources for the Future, Washington, October 8, 1992.

workers are empowered to continuously innovate on the plant floor. This reappraisal of people is also present at the regional level. Regions provide avenues to encourage the participation of communities in policy design and decision making. Community organizations play a major role in channeling local interests into action. These groups work together but share global objectives with the rest of society.

This new model sees the environment as a source of opportunity and competitive advantage. People make efforts to preserve the region's environment, reduce waste and support recycling. Including environmental concerns in their production decisions, firms acknowledge the generation of savings, increase in efficiency and creation of market niches. Recycling, use of scrap materials and the emergence of environmental industries are examples of this new approach to production.

Table 1: Old versus New Competitiveness

	Sustainable & Competitive Region	Old Competitiveness
General	Positive-sum game Knowledge as source of value Reappraisal of human capital and communities.	Zero-sum game Physical labor as source of value Underestimation of human capital
Actors	Catalytic function of government Firms look for quality production	Regulatory function of government Firms look for mass production
Environment	Environmental seen as source of competitiveness General awareness of environmental well-being	Environment seen as a burden and cost Government as primary steward

In contrast, the Old Competitiveness model was based on zero-sum game strategies which stressed conflicts: labor vs. management, production vs. environment, domestic vs. foreign, and others. The lack of interdependence among economic agents encouraged the prevalence of individual welfare without concern for others. Free-rider attitudes and a lack of cooperation to maintain common goods were commonplace. Collaboration between groups was less common. All too often, groups from different sectors had competing agendas, and government imposed top-down solutions to local problems.

The sources of competitiveness in the old model were economies of scale, and firms looked for lower costs. Organization in firms was hierarchical, with few channels of communication. The experience and expertise of workers was not tapped to its fullest potential. The environment was seen as an external factor to production. Pollution and depletion of natural resources were seen as unavoidable costs of doing business. In this scenario, the government was the only agent aimed at establishing pollution limits and reinvestment in natural resources.

Regional Approaches To the Competitive and Sustainable Region

Regional benchmarking was undertaken to discover leading economic and environmental practices around the world. Five regions were examined: Seattle, Washington; Chattanooga, Tennessee; Hamilton, Ontario; Kitakyushu, Japan; and Pittsburgh, Pennsylvania (*See Appendix A: Competitive And Sustainable*

Regions). Our approach focused on basic analyses of regional economies, identification of sustainable initiatives and their drivers, and a comparison of the initiatives on a variety of dimensions.

The five regions were selected for varied reasons. Chattanooga, Hamilton, and Kitakyushu, sharing a common background, were chosen for their similarities to Pittsburgh. All had a history of heavy industry inflicting serious damage on the local environment. The regions had also experienced structural economic shifts away from heavy industry and had succeeded in cleaning up their local environment. Seattle was included as an example of a healthy, growing region which is nevertheless giving more attention to its environmental quality.

Through direct contact with key representatives of government, business, environmental organizations, and economic development organizations, we developed new and unique information. (*see Appendix A: Competitive And Sustainable Regions*) From this information we identified patterns which provide the foundation for our Competitive and Sustainable Regional Model. We developed portraits of three types of regional strategies, termed Environment for Environment's Sake, the Green City and the Competitive and Sustainable Region. (See Table 2)

Environment for Environment's Sake

Regions pursuing sustainability initiatives sometimes pursue a strategy we call the Environment for the Environment's Sake (EES). Such regions devote time and resources to environmental improvement or preservation but do not effectively make the connection between protecting the environment and growing the local economy. Regions pursuing sustainability in this manner will typically focus on the value of living in a clean and healthy natural environment. They will focus on traditional environmental awareness and conservation or cleanup initiatives. Noticeably absent from regional sustainability strategies of this type is the strong participation of the private sector. They also lack policy initiatives or programs which attempt to lead industry to adopt production practices or philosophies which are more environmentally friendly. Finally, sustainability initiatives which fit these characteristics are typically dominated by a single driver.

Raising environmental awareness is the strongest focus for regions pursuing EES. Initiatives focus on changing the way individuals and businesses think about their interaction with the environment. This approach, without the inclusion of economic goals, seems only to make the most tentative steps toward comprehensive sustainability. We see examples of this effort to raise regional environmental awareness in several of the benchmarking regions. In Hamilton, Ontario, for example, community groups have developed a series of projects to reduce waste and limit water and energy consumption while also developing a community Health Status Information System. In Pittsburgh as well, environmental initiatives have focused mainly on environmental quality alone, although this approach may be changing (see Chapter 4).

In Seattle, however, we see the EES approach most broadly (see Figure 1). Sustainability initiatives in the Seattle area focus on raising awareness of the impact of everyday activities on the environment. Maintaining the environmental quality of the Puget Sound region is seen by many as a highly important ingredient for the maintenance of the region's quality of life. The city has adopted a comprehensive plan entitled "Toward a Sustainable Seattle" and a companion plan the city calls its "Environmental Action Agenda". The City of Seattle is heavily involved in environmental education both inside and outside of the public school system. Its purpose is to change the behavior of the city government, individual citizens, and commercial business with respect to the environment. The City of Seattle makes a wide variety of educational opportunities available to people of all ages, through the

interdepartmental Environmental Education Committee, which coordinates activities of the City's various departments, and through the assistance of an environmental education coordinator located in the Office for Education. Outside the school system, the city's efforts to raise awareness of environmental issues and promote environmental stewardship focus on such informal education as field trips, volunteer training, and fee-supported classes.

Figure 1: Seattle

<p>Seattle, Providing Environmental Education</p> <ul style="list-style-type: none">• Sustainable initiatives are spearheaded by multi-level government• Policy initiatives include Washington State Growth Management Act, Seattle Comprehensive Plan, Seattle Environmental Action Agenda• Focus on environmental quality initiatives• Little active support from local organized business or industry• Sustainable Seattle, a civic forum, has developed a set of indicators for measuring the city's sustainability.

Regions pursuing a strategy of EES focus their initiatives not only on awareness, but on such traditional environmental improvement initiatives as waste reduction and resource conservation. Accompanying such initiatives may be plans for promoting alternative transportation. What makes this type of sustainability initiative stand out from others is that an EES strategy will place such initiatives at its center, rather than uniting them with economic growth strategies. Among the ten goals of Seattle's Environmental Action Agenda are: reducing air pollution from wood burning, energy and water conservation, recycling, and noise pollution prevention. The city has also identified the reduction of automobile use as one of its top environmental objectives. The city's pursuit of this goal involves a balanced, multifaceted strategy of leading by example: providing convenient, competitive alternatives to car travel, promoting denser, more pedestrian- and transit-oriented urban design, and nudging people towards those alternatives with education and economic incentives. Other initiatives include reducing risks from storm-water overflow and encouraging conservation of materials in residences and commercial businesses.

Sustainability initiatives which lean toward the EES model are typically driven by a single dominant actor, whether that be the government, the community or a non-government organization. Typically, Environment for Environment's Sake initiatives are not actively supported by the private sector. As a service-provider, major employer and land-owner, a city has countless, daily opportunities to promote and demonstrate environmental stewardship through its actions in the community, and its interactions with both its employees and citizens. In some cases, it is the city's goal to seek out these opportunities, to take advantage of them in order to promote continued improvement in environmental stewardship within city government.

Seattle is an example of this government-dominated approach. In Seattle, state, county and local government are leading sustainability initiatives supported by clearly articulated policies. The Washington State Growth Management Act, planning initiatives in the King County Region, and the policies of Seattle city government have initiated the drive for sustainability in that region. Government leaders show a willingness to cooperate between levels of government to get the region's citizens more involved in pursuing sustainable living. While Sustainable Seattle, a civic forum, is also active in the area of sustainability, it does not play the dominant role that government does.

Community groups and non-government organizations, sometimes working in concert, also can act as the dominant driver. To some degree, community groups in Hamilton, Ontario play a dominant role on certain environmental initiatives. Hamilton has developed community partnerships in the region to promote tourism and market the region as a main convention center. In fact, Hamilton recently hosted the 1995 Environmental Summit that gathered the national environmental agencies of the seven largest industrialized countries. Hamilton is also marketing its surroundings as eco-environmental resorts. Pittsburgh offers similar examples. In the Pittsburgh region, the South Side Local Development Corporation, Slippery Rock

University and Conservation Consultants are three of the many organizations working on developing energy-efficient housing in Pittsburgh and its environments.

The Green City: Connecting Environmental Quality And Economic Growth

The Green City goes beyond seeing the environment as separate from the economy, explicitly uniting the goals of environmental improvement and economic growth. The Green City connects the two in an effort to recast its image as a "green" or "sustainable" region. Examples of such an effort can be seen both in Hamilton, Ontario and Chattanooga, Tennessee. Chattanooga, for example, has recently begun marketing itself as the "Environmental City", while Hamilton has made an effort to capitalize on its recognition as a city which is moving towards sustainability.

In the Green City, a coalition of active groups representing different elements of the community leads the initiative for sustainability. This coalition may take the form of an alliance between local government and the community, or a comprehensive alliance between the private sector, public sector, non-government organizations, and communities. It supports a variety of initiatives with the intent of stimulating economic growth which emphasizes the environment. Often, the Green City will clean up major environmental resources. This cleanup generates momentum which catalyzes "green" economic development.

Chattanooga, Tennessee, and Hamilton, Ontario are examples of regions where this multi-sector coalition of drivers has followed the process described above(see Figure 2). Chattanooga is known as a city which is successfully transforming its image from one of America's most polluted cities to one of the country's most sustainable. Since the late 1960's, the city has made great strides in repairing environmental damage to the Tennessee River, as well as major air quality improvements. Years of heavy industry in the region made the cleanups necessary. Since the city began its cleanup, an initiative born out of a community-based comprehensive goal-setting process called Vision 2000 has evolved into a comprehensive plan for remaking Chattanooga as "The Environmental City". This initiative enjoys the active support of city government, the local Chamber of Commerce, the Chattanooga community, and many local non-government organizations. One example of the cooperation of this coalition is the creation of a new business district development plan grounded in the principles of sustainability.

A similar process has occurred in Hamilton, Ontario. Also a formerly polluted industrial center, Hamilton was recently credited at the Earth Summit in Rio as a city which is moving toward sustainability. Sustainable development initiatives in Hamilton enjoy the active support of both government and the community. Similar to Chattanooga, Hamilton is developing a strategy for economic growth that stresses the economic benefits to be gained from continued improvement of the environment, such as its waterfront.

Finally, environmental initiatives in the Green City are often allied with other economic development goals, such as control of urban sprawl, revitalization of the urban core, and the maintenance of an efficient system of urban infrastructure. The Green City often finds that such objectives dovetail nicely with the principles of sustainable development.

Strategies for Developing Eco-Industries

The Green City uses several strategies to achieve sustainable economic development. These strategies can include the development of eco-tourism, the targeting of industries which provide environmental products and services for growth, and the development of zero-emissions zones. Examples of such strategies can be seen in several of the observed regions. One of Chattanooga's widely-acclaimed

recent successes has been the development of its downtown river front properties into major tourist attractions. The city's Tennessee Aquarium (a large, fresh-water aquarium) and its Riverwalk are environmental attractions which have been immensely successful at generating tourism for the city and revitalizing the downtown area. In Hamilton, efforts to develop lakefront properties as tourist attractions are a part of economic development strategies.

Chattanooga, The Environmental City

- Economic development strategy focuses on greening of city and its economic base
- Sustainability initiatives supported by Chamber of Commerce, local government, communities, non-government associations
- Developing eco-tourism, electric transportation, water quality industries
- Zoned downtown redevelopment area for zero-emissions industry
- Once known as one of the country's dirtiest cities, now seen as one of the emerging "sustainable" cities

Hamilton, Ontario Sustainable Region

- Former center of heavy industry recently recognized at the Earth Summit as a leader in sustainable practices
- Public sector and community actively support sustainability initiatives
- Focusing on development of eco-tourism and water quality industries
- Targeting green industries for economic growth
- Sustainability initiatives have active support of leading firms and academic institutions
- Formal economic development policy objectives centered around sustainability

Figure 2: Chattanooga and Hamilton

Eco-tourism is only one option for the Green City. Industries which provide environmental products and services are also targeted as potential growth engines. More explicitly, the Green City targets such industries as water quality improvement, alternative energy or transportation, as well as the development of R&D capacity in these areas. In Chattanooga, initiatives have highlighted the development of the water quality improvement industry, although this focus is in its early stages compared to the city's efforts to become a hub for the electric bus industry. Chattanooga has entered partnerships with research organizations in California and the local area for the development of electric buses. Today, the city serves as a laboratory for the use of these buses, as they currently serve the downtown area. Part of its development plans include research and development facilities for the further study of electric transportation technology.

In Hamilton, Ontario, the water quality industry is targeted as a potential engine of growth. Philip Environmental, a leading firm in wastewater management, has signed an agreement to manage one of the city's water treatment facilities and support research in the area. Similarly, in Burlington, a few miles away from Hamilton, the Wastewater Technology Center (WTC) is operating a provincial laboratory on a contract research basis. WTC is expanding its activities to the international market and has signed contracts with Mexico city.

Perhaps the most comprehensive development of eco-industry in the Green City is the creation of eco-industrial parks or zero-emissions industry. Eco-industrial parks are industrial parks where the wastes of one facility are used as inputs for another. This system is meant to serve as an industrial eco-system, where no materials are wasted. Zero-emissions industry is connected to this concept. Again, Chattanooga provides examples of these types of initiatives. Currently underway are plans for two eco-industrial parks in the Chattanooga area. While one park lies outside of the city core, a second would be located in the center of the city's high-profile South Central Business District. Initiatives in both Chattanooga and Pittsburgh include the goal of developing zero-emissions industry. Chattanooga has zoned parts of its South Central Business District for zero-emissions industry, and such firms as DuPont and Collins Carpet have expressed preliminary interest in locating facilities there. Pittsburgh's Steel Valley Authority and others support an initiative for the development of zero-

emissions industrial parks in the region's Monongahela Valley. Both the Pittsburgh and the Chattanooga initiatives are ironic in that the zero-emissions facilities would be located in the heart of what were once areas of heavy industrial activity.

Toward a Competitive and Sustainable Region

A third regional model comes closest to achieving competitiveness and sustainability and thus we term it the Competitive and Sustainable Region. The Competitive and Sustainable Region integrates the environment and economic growth. In doing so, it focuses on the following issues: the environment as an integral part of business practice, recognition that people are an asset for high performance, emphasis on continuous innovation of technology, combination of cost-reduction with a customer/market-driven strategy, competitive partnerships, and the catalytic role of government. The best example of this model is Kitakyushu, Japan.

Figure 3: Kitakyushu

Kitakyushu, Integrating the Environment and High-Performance Industry

- Accomplished major environmental cleanup in the past thirty years
- Incorporated sustainable business practices into high-performance business practices
- Internalized environmental costs into business practices
- Invested in human capital
- Incorporates innovative technology, develops R&D and information networks.
- Combines strategy of lower cost, differentiation, and market niche development
- Integrated partnership of public, private sectors with commitment to sustainability and vision-based leadership
- Adopted catalytic role for government

The integration of environmental protection into industrial practice is the underlying element of the Competitive and Sustainable Region. At the business or corporate level, environmental concerns are regarded as one of the key considerations for business activity, going beyond mere compliance with environmental regulation. A company's business plan involves the environment as well as production, R&D, sales and marketing.

In Kitakyushu, many companies developed environmental divisions in response to the severe pollution problems experienced in the 1960's. Since overcoming the pollution crisis, these firms have maintained those divisions while changing their mission from clean-up to contribution to R&D for environmentally-friendly products. The assessment of environmental costs are assimilated into all cost-benefit calculations.

Similarly, in firms in the Competitive and Sustainable Region, environmental costs are counted as fixed costs, not as variable costs such as raw materials. The long-term environmental impact of production is fully considered. In Pittsburgh, for example, the world-leading aluminum producer Alcoa has made such efforts to reach compliance in terms of air quality, waste disposal and energy consumption.

A second key feature observed in the Competitive and Sustainable Region is the recognition of employees as an asset and an active component of high-performance manufacturing. The Old Competitiveness model views employees as just one of many resources used to achieve production or profit maximization. Competitive firms in the new model utilize the best of employees' intelligence, knowledge, and ideas in the workplace. Thus, companies invest in their human capital to generate future benefits.

Examples of such practices can be found worldwide. Toshiba in Kitakyushu harnesses the ability and experience of employees through Quality Circles and Total Quality Control. The company has held the dominant position in the industry in terms of quality, delivery, and cost. Stelco in Hamilton launched an ongoing training program called "WIN" in 1988. It has invested in its management and employees, with the goal of challenging its work force to change with the time. Another example is Sony Corporation, located in southwestern Pennsylvania. The firm relies on the intelligence and ideas of its workers and suppliers to achieve high productivity and approach zero emissions.

Emphasis on continuous technology innovation for both new products and environmental quality improvement is the third key feature for firms in the Competitive and Sustainable Region. R&D is

considered essential for continuous improvement and is reinforced by the regional provision of information networks. Illustrations of the importance of R&D and a quality information infrastructure are seen in several regions. In Kitakyushu, the Kitakyushu Techno-Center was established in 1990 for the purpose of supporting R&D, cross-industrial information exchange, business incubation, and training. This center has been an effective interface between regional manufacturing companies, polytechnic universities, and the prefecture's industrial technology center. The Pittsburgh region's Steel Valley Authority's Sustainable Valley initiatives has the development of environmentally responsible technology as its goal.

A final key feature of firms in the Competitive and Sustainable Region is their constant effort to reduce production costs at the factory level, in accordance with corporate-level decision making. For the metal, chemicals, and automobile industries in Kitakyushu especially, the most important strategy has been cost reduction. New strategies combine cost reduction with product differentiation or market niche development. This strategy involves two goals: cost reduction at the production level, and differentiation or market niche development at the marketing and planning level. Companies still seek cost reduction as a competitive edge against companies which produce goods of similar quality. For example, Nippon Steel, one of the biggest steel companies in the world, is attempting huge cost reductions in the production of specialized high value-added thin steel for automobiles. Pittsburgh-based Allegheny Ludlum Corp., producing specialty materials for diversified use in the worldwide consumer and capital goods markets, has also adopted a cost-reduction strategy based on specialization.

The Competitive and Sustainable Region displays new partnerships pursuing economic development. These regions will often forge partnerships between the public/private sectors and the community. Partnerships for comprehensive sustainability are stressed in this type of region. For example, the Kitakyushu International Tech-cooperative Association (KITA) was inaugurated in 1980 with the Kitakyushu Junior Chamber and the Chamber of Commerce as its main supporting organizations. This organization was founded with the cooperation of local governments for the purpose of transferring technology accumulated in Kitakyushu to developing nations. The Kitakyushu Techno-Center, which was also established with public and private cooperation, is serving to research and develop new products for upgrading the level of regional industrial technology and is the centerpiece of a high-technology park.

In the Competitive and Sustainable Region, a shared vision effectively binds and strengthens partnerships between business, government and the community. This shared vision provides a "map" for the development of the city and can be proposed by any stakeholder group in the community. Leadership binds such diverse actors as the public/private sectors and community groups together. In Kitakyushu, for example, business leaders and organizations actively propose visions for the city's future, often with the participation of community organizations.

Finally, local government support is a key factor for competitive sustainability, although leadership from any sector can be effective. Across the board, we have seen local government play a key role. The Competitive and Sustainable Region stresses the role of the government as a catalyst for development rather than simply as a director mandating economic change. The government supports businesses in their pursuit of high-performance manufacturing and reinvestment by providing support through information infrastructure, R&D, and employee training.

Examples of the catalytic role of local government can be seen in several regions. This role is clear in Kitakyushu. The city offers firms designing environmentally-friendly factories loans at low interest rates. In addition, Kitakyushu promotes itself as an emerging international hub. It has established a Convention Bureau and the Asia-Pacific Import Mart which will be a core facility in the Kitakyushu Foreign Access

Zone. Further, loan guarantees, accelerated depreciation, and low interest rate loans to support such activities as entrepreneurship and industrial structural change are facilitated by the central government.

Table 2: Comparing Patterns

	Environment for Environment's Sake	Green City	Competitive and Sustainable Region
Vision	• High quality of life	• Environmentally friendly city	• Competitiveness and high performance
Goal	• Increase environmental awareness	• Market "green" image • Clean-up • Eco-industry	• Integration of functions and sectors
Key Actors	• Single dominant actor (government, community or NGO)	• Business, government and community	• Business, government and community
Environmental Focus	• Part of high quality of life awareness focus	• Springboard for economic growth	• Element of economic growth
Dimensions	• Unclear connection with economic growth • Basic environmental awareness • Single-dominant driver	• Efforts to develop an environmental industrial sector • Weak integration of environmental expertise into the manufacturing activity • Active role of government and community • High value of environment	• Environment as imperative • Human capital as an asset • Continuous innovation • Various business strategy • Active involvement of all sectors • Catalytic role of government

Section Summary

Regions are clearly seizing the environment as a vehicle for economic growth. Some regions approach the environment for the environment's sake. They are banking that environmental improvements will make the quality of life for the region more appealing, thus making the city more livable and marketable. Other cities are centering their economic development strategies on the environment, trying to cultivate a "green" image through the development of industries which focus on environmental attractions, goods, and services. Finally, regions are making the connection between high-performance manufacturing and the environment by embedding environmental protection into the high-performance paradigm.

The most influential factors for characterizing the economic development of a region, however, are the composition and practices of its industrial and business base. The practices of these businesses and industries and their production philosophies have a profound effect on the local economy. The next section will focus on methods today's firms are using to integrate environmental concerns with economic ones. Through an analysis of current business practices, we will look for emerging trends within the national industrial community.

Table 3: Environmental Initiative Checklist

		Chattanooga	Hamilton	Kitakyushu	Pittsburgh	Seattle
Concerted Vision		✓	✓	✓		✓
Environment	Seen as a source of competitive advantage	✓	✓	✓		
	Seen as a source of quality of life improvement	✓	✓	✓	✓	✓
	Part of economic growth strategy	✓	✓	✓		
Government and Policy	Formal comprehensive sustainability policy	✓	✓			✓
	Large local environmental regulatory role	✓	✓	✓		
	Supportive of green industry development	✓	✓			✓
	Active involvement in public/private partnerships	✓	✓	✓		
Industry and Business Activity	Development of eco-industrial parks	✓		✓		
	Plans for zero-emissions industry	✓			✓	
	Strong eco-tourism industry	✓	✓		✓	
	Dominance of high-performance manufacturing		✓	✓		
	Strong human capital investment		✓	✓		
	Organized business support for sustainability initiatives	✓	✓	✓		
Community Activity	Education improvement as priority for region	✓	✓		✓	✓
	Strong community group support for sustainable development initiatives	✓	✓			✓
	Active community presence in economic development planning	✓	✓	✓	✓	✓

Business, Competitiveness and the Environment

Chapter 3 : Business, Competitiveness, and the Environment

Business is the fundamental driver of wealth creation and economic development. The past decade has witnessed a tremendous shift in the way businesses is organized. (See Table 4) The factors of the new competitiveness include:

- Shift to high performance production
- The flattening of traditional hierarchical structure
- Training and development of employees
- Self-managing teams
- Co-dependent supplier relationships
- Environment as a source of competitive advantage

Table 4: Business Approaches to the Old and New Competitiveness

<i>OLD COMPETITIVENESS</i>	<i>NEW COMPETITIVENESS</i>
<ul style="list-style-type: none"> • Scientific Management/ Mass Production • Hierarchical Structure • Rigid Job Classifications • Assembly Line Production • Adversarial Relationship Labor and Management • Split Between Intellectual and Physical Labor • Arm's Length Supplier Relations • Environment versus Profit 	<ul style="list-style-type: none"> • High-Performance • Flattened Organizational Structure • Constant Training and Employee Development • Just-In-Time Production • Self-Managing Work Teams • Emphasis on Intellectual Labor and Problem-Solving • Co-Dependent Supplier Relations • Environment as a Competitive Advantage

The New Competitiveness differs vastly from the Old Competitiveness which focused on an hierarchical management structure. Production processes were designed along an assembly line model. Employees and management were adversaries and intellectual labor was not harnessed. Relationships between suppliers and their customers were not encouraged. Damage to the environment was seen as an inevitable outcome of production and business practices.

The New Competitiveness offers pathways for environmental management and pollution prevention strategies. Fundamental elements of these strategies include emphases on cost reduction, waste minimization, and continuous improvement. The high-performance revolution offers a route for resolving the traditional conflict between the environment and industry. One of the cornerstones of this New Competitiveness is the shift towards Z³ (zero defects, zero inventory, and zero emissions). Companies during the 1970's talked about acceptable quality levels and the cost of quality. Quality is now a prerequisite for competitiveness. The issue is similar today when companies talk about acceptable levels of

emissions and the cost of environmental compliance. Just as companies had to move toward zero defects and zero inventory, so too must organizations today move toward zero emissions if they want to compete in the future.

Corporate Environmental Best Practices

A growing body of research suggests that business is in the midst of a shift in its fundamental approach to solving environmental problems.⁴ Firms, particularly manufacturing ones, are finding innovative ways to prevent pollution. These new methods reflect a shift from the more traditional ways of pollution control (i.e. end-of-pipe technology), to a focus on earlier stages of the production process; on introducing new, less polluting product technology; and on employing the principles of Total Quality Management to address environmental issues. Further, firms utilize "green" technology and production processes not only as a way to reduce pollution, but also as a means for lowering costs. These costs include not only the avoided costs of fines or taxes for excessive emissions, but also the direct costs associated with production. In other words, the search for cleaner production methods forces companies to examine in detail the specifics of their activities, which in turn leads to innovation and market advantage.

To identify corporate environmental best practices, we sent a survey addressing the issues outlined above to approximately 400 manufacturing firms nationwide (see *Appendix B: Investment in Pollution Abatement and Control*). The fundamental question which our survey investigated was, "Are companies pursuing different environmental strategies than in the past?" Within this framework it addressed the impetus for pollution prevention, the identity of the innovative firms and their decision-making process, and the innovations being undertaken.

To make the sample representative, the survey was sent to 250 firms from Standard and Poor's 500 Index, approximately 100 firms from the S&P Midcap 400, and 100 firms from the S&P Smallcap 600. The 99 respondents included 45 from the 500 Index, 38 from the 400 and 15 from the 600. While it is conceivable that primarily the innovative and successful firms responded to the survey, thus presenting a sampling bias, the survey was intended to zero in on the innovators.

Pollution Prevention

Pollution prevention expenditures of manufacturers are significant and growing. In the latest available survey of expenditures on pollution prevention (1993), the US Department of Commerce asked manufacturing firms to report the resources they devote to pollution prevention.⁵ In 1993, pollution abatement and control expenditures (PACE) totaled \$7.2 billion. Just as important, firms are shifting their pollution abatement capital expenditures from the traditional end-of-line (EOL) techniques to production process enhancements (PPE). In 1993, the U.S. Bureau of Census stated that U.S. businesses spent over \$7.1 billion on pollution abatement. Of this figure, almost half (\$3.2 billion) was spent on production process enhancements.

Figure 4: *Factors Affecting Environmental Strategies*

- ✓ *Corporate Citizenship*
- ✓ *Regulations*
- ✓ *Improving Technologies*
- ✓ *Increased Productivity*

⁴ Quality Environmental Management Subcommittee, President's Commission on Environmental Quality, "Total Quality Management: A Framework for Pollution Prevention," January, 1993

⁵ US Bureau of Census. *Current Industrial Reports: MA200(93)-1; Pollution Abatement Costs and Expenditures, 1993..* Washington, DC: US Government Printing Office, 1994. Also used 1981-1991 reports.

The survey shed light on companies' attitudes toward pollution prevention. It showed that 39% of companies surveyed believe that pollution prevention is "very important" to their overall corporate performance and 38% believe it is "important". These answers indicate that a significant portion of manufacturers recognize the business gains offered by improving environmental performance.

The survey next addressed whether these gains are in the form of avoided fines and regulatory penalties or are direct gains. Companies were asked to rate a variety of factors affecting their environmental strategy on a scale of one to four, where four was very important and one was not important. "Regulations" and "corporate citizenship" tied at 3.3, the highest average answer. However, "improving technologies" and "increased productivity" followed with average answers of 3.0 and 2.9, respectively. Again, these answers indicate that certain firms are realizing financial and technological gains through environmental action.

The survey also attempted to identify pollution prevention activities being undertaken by firms. It asked companies to list the main elements of their pollution prevention strategy and to list specific production process improvements that have played a significant role in that strategy. Of the strategy choices, "treatment" and "end of pipe control technology" represented the old paradigm of pollution prevention, while "facility downsizing," "source reduction," "recycling," and "production process improvement" represented the answers expected of innovators. The old paradigm was checked 49% (treatment) and 23% (end of pipe), while innovative activities were checked 89% (source reduction), 85% (recycling) and 87% (process improvement). The survey responses indicate that companies are finding new ways of preventing pollution, and that the adage of "reduce, reuse, recycle" is being employed within firms.

Figure 5: Strategies for Pollution Prevention

√Source Reduction
 √Production Process Improvement
 √Recycling

The specific production process improvements that firms reported further supports this view. Seventy-six percent reported the upgrade of existing process technologies: 67% reported the introduction of new process technologies, and 75% reported recycling. Additionally, 51% reported that they have converted to a "closed or partially closed loop system." Closed loop processes are premised on the notion that waste can be utilized as inputs to another (or occasionally the same) production process. As this process requires a true symbiosis of production facilities and a true fusion of technologies, it is both surprising and encouraging that so many firms have sought out this alternative.

An additional indicator of what firms are doing to address pollution prevention is the fact that 40% of the respondents identified themselves as having Total Quality Environmental Management (TQEM) programs in place. By forcing companies to examine the intricacies of their operations, to use full cost accounting to assign specific costs to waste, and to allow for the empowerment and input of all players related to their operations, TQEM helps companies to reduce waste and pollution creatively.

Figure 6: The Changing Face of Manufacturing

40% of the firms surveyed use TQEM, and 50% use a closed loop or partially closed loop system.

Some companies may employ parts of a TQEM strategy without formally adopting the nomenclature. This gap between theory and practice was revealed by respondents' listings of the key actors involved in formulating pollution prevention strategies. This question showed that companies are soliciting advice not only from top management, engineers, and R & D staff, but also from line workers (63%), suppliers (45%) and customers (35%).

The identity of innovative firms can be determined in various ways. Most superficially, the percentages of respondents from the S & P indices provide some insight. Larger firms made up a greater portion of our sample than smaller firms. More in-depth studies of the answers reveal similar trends. For example, the larger firms tended to have greater pollution reductions over the last year. One interpretation is that larger firms have the capability to institute new programs more readily than smaller firms.

By cross-tabulating the answers or splitting the sample into two groups based on a given answer, the survey data can be used to more deeply investigate best-practice issues. We compared the answers of companies who responded that pollution prevention was "very important" to their corporate performance with those who said otherwise, the answers of those with and without TQEM programs, the answers of those who have reduced pollution by more than 10% over the last year with those who have not done so, the answers of those employing closed loop processes with others, and finally, the answers of those who identified suppliers as having key roles in their environmental strategy with those who did not. The results were interesting and generally consistent with our hypothesis.

Pollution Prevention and Corporate Performance

One of the basic premises of the project is that there is a sizable number of manufacturers who recognize the importance of pollution prevention to corporate performance. We examined this issue directly by asking companies to rate how important (on a scale of "not important", "somewhat important", "important", and "very important") pollution prevention was to their overall corporate performance. This premise was tested by comparing the survey answers of companies which answered "very important" to those which answered otherwise. The results show some significant dichotomies.

One image of an environmentally progressive company is that of a company which recognizes ways other than treatment of pollution or "end-of-pipe" solutions to emissions. As an alternative to these methods of pollution reduction, progressive companies have looked to production process improvements. The survey bears out these theories. Only 41% of companies which rate pollution prevention as "very important" use treatment as part of their pollution prevention strategy, as opposed to the 59% of companies who do not consider pollution prevention very important. Along similar lines, 59% of companies who answered "very important" cited the introduction of new product technology as a strategy, as opposed to 41% of the other companies.

Figure 7: Pollution Prevention and Product Technology

Almost 60% of firms who view pollution prevention as very important to their corporate performance employ new product technology as part of their strategy.

Role of Suppliers

Another key characteristic of an environmentally progressive firm is the inclusion of suppliers as one of the key players in their pollution prevention strategy. About 50% of the companies which rate pollution prevention as a "very important" element of their corporate performance consider suppliers as key players in their overall environmental strategy more frequently than firms which view pollution prevention as less than "very important." A company's consideration of suppliers in their pollution prevention strategy seems also to be relevant to some specific production process improvements they adopt. In this regard, specific process improvements are based on the introduction of new product technology for 58% of the

companies which take into account suppliers; for 87% of the firms, suppliers can be related to the upgrading of existing process technologies. However, there does not seem to be a relationship between the use of external players, suppliers and distributors with the implementation of environmental programs like TQEM or the pursuit of zero emissions standards.

Closed Loop Systems

One alternative progressive firms are using is the conversion to closed or partially closed loop systems. Sixty percent of the firms which use closed loop or partially closed loop systems cite "treatment" as one of the main elements of their pollution prevention strategy. However only 39% of the other group of companies which use different production process improvements use treatment as a pollution strategy. Recycling is another production process improvement used by most of the firms which use closed loop systems (82%). In the case of the other group of firms, only 67% of them cite "recycling" as a specific improvement applied. At the same time, 30% of the firms which implemented closed loop systems use end-of-pipe technology to reduce emissions. By contrast, 16% firms which do not use closed-loop systems use end-of-pipe emissions controls.

In terms of the key players in their pollution prevention strategy, the companies with closed loop systems cite R&D staff and line workers more frequently than firms which do not use closed loop systems as a production process improvement. One basic premise of the use of specific production process improvements like closed loop systems is that their use contributes considerably to reducing the level of emissions. Survey results seem to corroborate this premise. For 22% of the companies which use this technique, the percentage of pollution emissions reductions over one fiscal year is from 26-100%. By contrast, only 6% of the companies which do not use that type of process improvement have achieved similar levels of emission reductions.

Total Quality Environmental Management

Another aspect of the environmentally progressive company is the acceptance of input from the many actors in its business life in the development of an environmental strategy. In other words, more conservative companies will rely primarily on senior management, while progressive companies will ask for the input of a range of other parties. Again, this premise is borne out by the survey results. Companies which rate pollution prevention as "very important" to their corporate performance cite line workers, suppliers and distributors as key actors in their pollution prevention strategy more frequently than companies which view pollution prevention as less than "very important." This point is most striking when comparing the use of Total Quality Environmental Management (TQEM). Fifty-nine percent of companies which answered "very important" also have a TQEM program in place, as opposed to only 30% of other companies.

Because of the stark contrast in the TQEM category, and because having a TQEM program is itself an indication of a company's commitment to pollution prevention, the survey was split to compare the

Figure 8: Suppliers

Of firms that cite suppliers as key players in their environmental strategy, almost 60% introduce new technology and almost 90% upgrade existing technology as part of their environmental strategy.

Figure 9: Closed Loop Systems

Of firms that use closed loop systems, almost one fifth reduced emissions by as much as 26 to 100% over just the last fiscal year.

Figure 10: TQEM

60% of firms who rate pollution prevention "very important" also employ TQEM. 70% of firms that use TQEM use R & D staff as key players in their environmental strategy.

answers of companies using TQEM with the rest. The results were very similar to those noted above. Companies which have TQEM programs are more likely to rate pollution prevention as "very important." In addition, they cite the introduction of new product and process technology as factors in their pollution prevention strategy more often. Another significant difference is that companies which employ TQEM cite research and development staff as major players in their strategy 68% of the time, as opposed to 47% for other companies. One statistic which we could not reconcile is that companies which employ TQEM use a strategy of treatment more often than other companies (70% to 38%). This result is somewhat problematic in that we consider treatment an outmoded, unproductive method of pollution prevention. It is part of the Old Competitiveness model. One possible explanation for this discrepancy is that, since TQEM involves a very detailed examination of all processes and is a relatively new phenomenon, TQEM companies may have identified more waste but not yet found the process improvement by which to eliminate them. Another possible explanation is that TQEM was invented and is often initiated by environmental compliance officers whose job focuses on treatment methods.

Large Emissions Reducers

Of the national companies surveyed, approximately 53% reported emissions reductions of greater than 10% in the last year. The report takes a closer look at the characteristics of this group of companies, comparing them to the companies which reported emissions reductions of less than 10%. Most of the "big reducers," (58%) were from the Standard & Poor 500 Index. The "small reducers" of emissions were composed of 32% from S & P 500 and 48% from the S & P Midcap 400.

Companies were asked to rate various factors based on their importance in affecting the company's environmental strategy. The scores were on a scale of 1 to 4 with 4 meaning "very important" and 1 meaning "not important." Big reducers seemed to recognize the importance of pollution prevention in serving key customers more often than firms achieving less than 10% emissions reductions. The big reducers gave an average score of 3.1 to "serving key customers," while the small reducers gave this factor only a 2.3. "Increasing productivity" also seemed more important to big reducers, which gave it a 3.1 average rating while small reducers gave this factor an average score of 2.5.

The choice of treatment as a main element of their pollution prevention strategy was greater for those companies with high reductions than those achieving less than 10% emissions reductions. Of big reducers, 67% selected treatment as a main element. Of the small reducers, only 32% said treatment was a main element of their strategy. As described earlier, the results for the treatment question are strange because reliance on treatment resembles the "Old Competitiveness" model of corporate environmental compliance.

In both groups, many companies responded that production process improvement was an important element of their strategy. Eighty-eight percent of big reducers and 81% of small reducers considered production process improvements as main elements of their strategy. When asked which specific improvements played a significant role in their strategy, big reducers chose conversion to a closed or partially closed loop system much more frequently than small reducers. Sixty-three percent of big reducers

Figure 11: Large Emissions' Reducers

Firms that reduced pollution by more than 10% over the last fiscal year:

- ✓ Pay more attention to customers than other firms
- ✓ Attribute greater importance to increased productivity as an impetus for pollution prevention
- ✓ Use production process improvements to meet their environmental goals
- ✓ Are more likely than other firms to use closed loop processes
- ✓ Are more likely to use new process technologies
- ✓ Are more likely to use R & D staff

chose this element, while only 32% of small reducers did. There also seemed to be a difference in how members of these two groups used the introduction of new process technologies. Seventy-one percent of big reducers chose this approach as a part of their strategy, while only 55% of the small reducers indicated that it was a part of theirs.

In indicating who the key actors were in their pollution prevention strategy, the firms achieving greater than 10% emissions reductions relied more heavily on R&D staff than those firms achieving less than 10% emissions reductions. Eighty-three percent of big reducers chose such staff as key actors. By contrast, only 48% of small reducers did.

The big reducers in this sample employ the progressive pollution prevention techniques of the New Competitiveness. They are inspired by the need to serve customers and to improve productivity. Eighty-eight percent of these firms focus on production process improvements as a pollution prevention strategy, while only 25% still use end-of-pipe control technology as part of that strategy.

Case Study 1: Sony Corporation's Environmental Strategy

Sony Corporation realizes that the keys to competitive advantage are no longer simply improvements to product quality but also improvements to environmental quality. High performance companies pursue three main objectives: zero defects, zero inventory, and zero emissions (the Z³ strategy). To improve environmental quality, Sony has adopted a comprehensive environmental plan, Global Environmental Policy, whose main premise is that Sony is, "...committed to protecting and improving the environment in all areas of the company's operations, thereby preserving and enhancing the quality of life of our employees, customers, and neighbors... to continually seek the improvement of environmental quality as it relates to our products, our packaging, and our operations. Development and implementation of this policy is a commitment of management and a shared responsibility with our employees."

Sony models their plan after ISO 9000, and the organization hopes to incorporate the variables from ISO 14,000 in the near future. The following are a few objectives outlined in their plan⁶:

- To encourage the implementation of measures aimed at preventing pollution through reducing the amount of waste generated, recycling of as much waste as possible, and ensuring the proper disposal of waste that cannot be recycled.
- To develop sound environmental goals for product and packaging disposal.
- To consider environmental issues at all stages of product research, development, design, production, distribution, application, service, and disposal.
- To consider environmental issues in locating and developing office, warehouse, production, and manufacturing facilities.
- To provide Sony's employees with a better understanding of environmental issues.

Sample Strategies

One of Sony's main strategies is the development of better supplier relations. Sony has a comprehensive set of quality standards that its suppliers must follow, and the corporation meets with its suppliers regularly to find ways to reduce costs. For example, Sony's Pittsburgh facility teamed up with one of its suppliers, Tuscarora, to redesign the packaging of equipment. The new packaging design used less material. They are also collaborating with one of their paint suppliers to create a water-based substitute for its current chemical-based paints.

In addition, Sony aggressively pursues "take-back" programs for its products. The majority of the materials used in its televisions can be recycled. Sony requires its employees to recycle at its plants. Recycling bins are visible throughout the facilities. Sony also conducts annual environmental audits of its facilities, using teams of internal and external auditors, to evaluate the environmental impact of its business activities.

⁶ A complete copy of the "basic policy" and "plan objectives" as outlined in Sony's environmental plan is in the Appendix.

Section Summary

Building a strong industrial foundation requires companies to integrate pollution prevention into their overall business strategies. There is ample evidence that national companies are adopting new and innovative approaches to environmental management. These companies are investing in:

- Production process improvements
- Closed loop systems
- Total quality environmental management
- Better supplier relationships

In short, pollution prevention is a fundamental element of the new high performance strategy. Innovative businesses, as well as regions, are pursuing new strategies that stress the positive correlation between environmental quality and economic development. The environment is linked to competitive advantage. The question now is: how can the Pittsburgh region position itself as a innovative leader in this new competitiveness?

Positioning Pittsburgh for the New Competitiveness

Chapter 4 : Positioning Pittsburgh for the New Competitiveness

The issue that remains is: how can Pittsburgh link its environmental and economic resources? Pittsburgh has a rich history of coming together to increase the strength and viability of the local economy and environment. In the early twentieth century, the availability of natural resources and a strong market for steel helped Pittsburgh to become the sixth largest metropolitan area in the country. In the late 1930's, public and private organizations believed environmental reforms were essential for the health of the region. Recognizing a common interest in improving the city, key officials of the public and private sectors, including corporations, banks, realtors, foundations and universities, spurred the creation of a regional entity to facilitate that project. That entity was the Allegheny Conference on Community Development.

The Allegheny Conference facilitated the major changes for which Pittsburgh has received world recognition. The smoke abatement programs of the 1940's and 1950's helped the city shed its image as the smoky city. Downtown development programs which created the Golden Triangle and spurred major building construction helped develop the downtown area as a vital and spectacular cityscape. It is now time to revitalize the very key to the historical success of Pittsburgh: its manufacturing base. The Pittsburgh economy has undergone a major change in the last ten to twenty years. We must now consider the environment and industry as resources to help Pittsburgh move into the twenty first century.

Environment and Economic Performance

To get a clearer picture of how Pittsburgh's environment and economic performance compares to that of other regions, we compared the economic and environmental performance of Pittsburgh to twenty-eight other metropolitan regions. The key question we asked is: what is the relationship between economic and environmental performance in leading regions throughout the United States? To accomplish this task we developed a set of indicators. We then hypothesized a relationship between the environment and the economy within a defined industrial structure and regulatory framework. (see Figure 12) Investment, productivity, output, and environmental performance were included as elements, assumed to be interdependent.

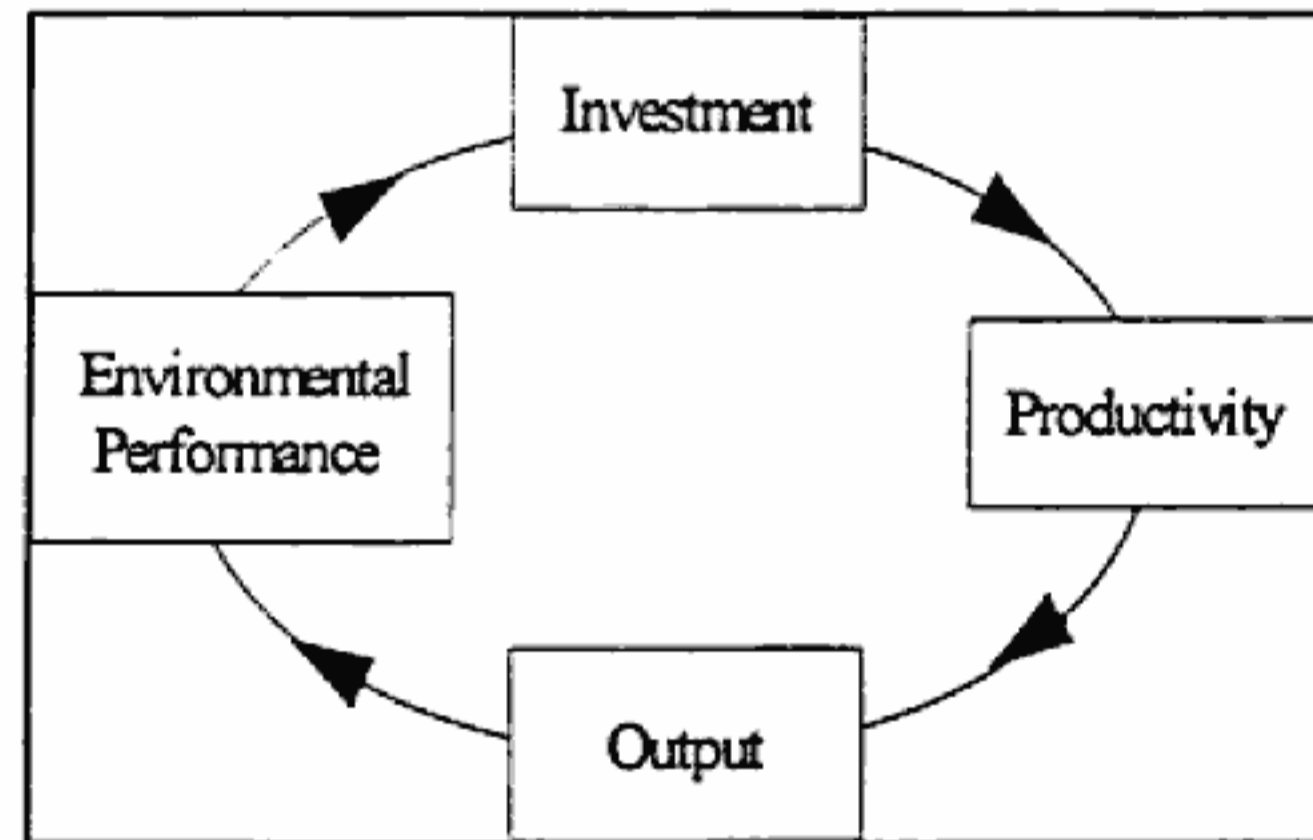


Figure 12: Economic and Environment Relationships

Our study used variables from the 1987 Census of Manufacturing to capture the economic factors within the industrial structure (See *Appendix B: Investment in Pollution Abatement and Control*). The variables have been defined as follows:

Productivity: Value added per manufacturing worker.
Investment: Total capital expenditures per dollar of shipments.
Output: Total value of shipments

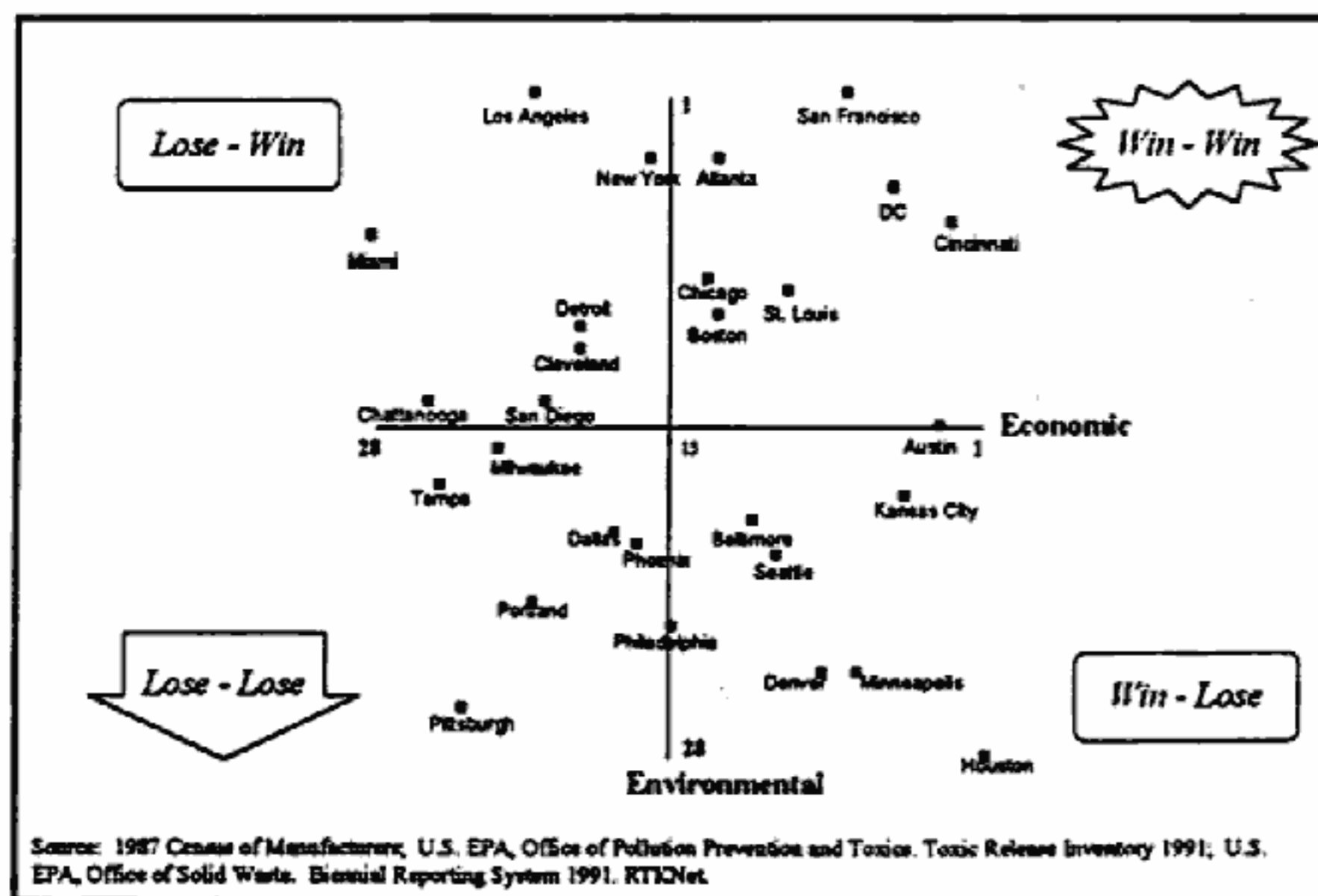
The environmental indicators provide a good estimate of pollution levels attributable to industry. The data covers air pollution and hazardous waste generated by manufacturing firms, including utilities. The main source of data for air pollution is the *1991 Toxic Release Inventory*. Information on facilities releasing toxic chemicals to the environment is collected yearly as required by the Emergency Planning and Community Right-To-Know Act. Our main source of data for solid waste is the *1991 Biennial Reporting System*. Information on facilities generating hazardous waste is collected every two years as required by the Resource Conservation and Recovery Act. We used 1991 data for this report which allows us to capture the greatest number of regulated chemicals. More specifically, the environmental indicators have been defined as follows:

Sum of Air Releases: Pounds of toxic air pollutants released per dollar of shipment. Data collected by county, aggregated to the MSA level.
Hazardous Waste Generated: Tons of hazardous waste produced by large quantity generators per dollar of shipment. Data collected by county, aggregated to the MSA level.

Pittsburgh's Economic and Environmental Performance

We compared Pittsburgh to 27 Metropolitan Statistical Areas (MSAs). The lists of MSAs and the result of the rankings are available in *Appendix E: Economic and Environmental Indicators*. Our goal was to see where Pittsburgh ranked. The diagram below captures both the environmental and economic dimensions of our results. Productivity is used for the economic axis. The environmental axis is an average of hazardous waste and air release rankings. Figure 13 provides an overview by showing in four quadrants the winners and losers of the rankings.

Figure 13: Metropolitan Economic - Environmental Rankings



The layout of the data shows that there is substantial variation in economic and environmental performance across the 28 MSAs. The four quadrants are defined by the position along the two axis and can be characterized as follows:

- **Win-Win:** Contains regions which rank high on both the environmental and economic axes.
- **Lose-Win:** Contains regions which rank low on the economic axis and high on the environmental axis.
- **Win-Lose:** Contains regions which rank high on the economic axis and low on the environmental axis.
- **Lose-Lose:** Contains regions which rank low on both the economic and environmental axes.

Located in the Lose-Lose quadrant, the Pittsburgh region can improve on both dimensions. This position indicates that the region fares worse than those which lie within the first three quadrants (at least winning on one dimension). While some of the regions in these upper quadrants have comparable industrial histories, it is unclear what factors have influenced their positions in the diagram. While Pittsburgh's environment has significantly improved since the 1940s, its industrial sector is still comprised of large toxic producers as ranked by TRI and BRS. Additionally, Pittsburgh does not appear to have the level of manufacturing productivity necessary to lie within one of the winning quadrants. Thus, the region ranks low on both dimensions.

This result may seem at odds with the general impression most citizens have of Pittsburgh as a city which has cleaned up its environment since World War II. The World Resources Institute ranks Pittsburgh fourteenth of 75 US metropolitan areas in their "Green Metro Index."⁷ This index includes general air and water quality measures and measures of citizen activity such as mass transit use, energy use and prices. The environmental-economic indicators developed in this report focus on just the industrial sector's performance and heavily weight its economic performance. Pittsburgh's low environmental rank on our indicators is caused by the fact that the manufacturing sector here produces relatively more toxic waste per dollar of manufacturing output than the other MSAs studied.

We do not have time series data to allow us to detect patterns of movement along the two axes. However, this kind of "point-in-time" benchmarking can be valuable information for any region

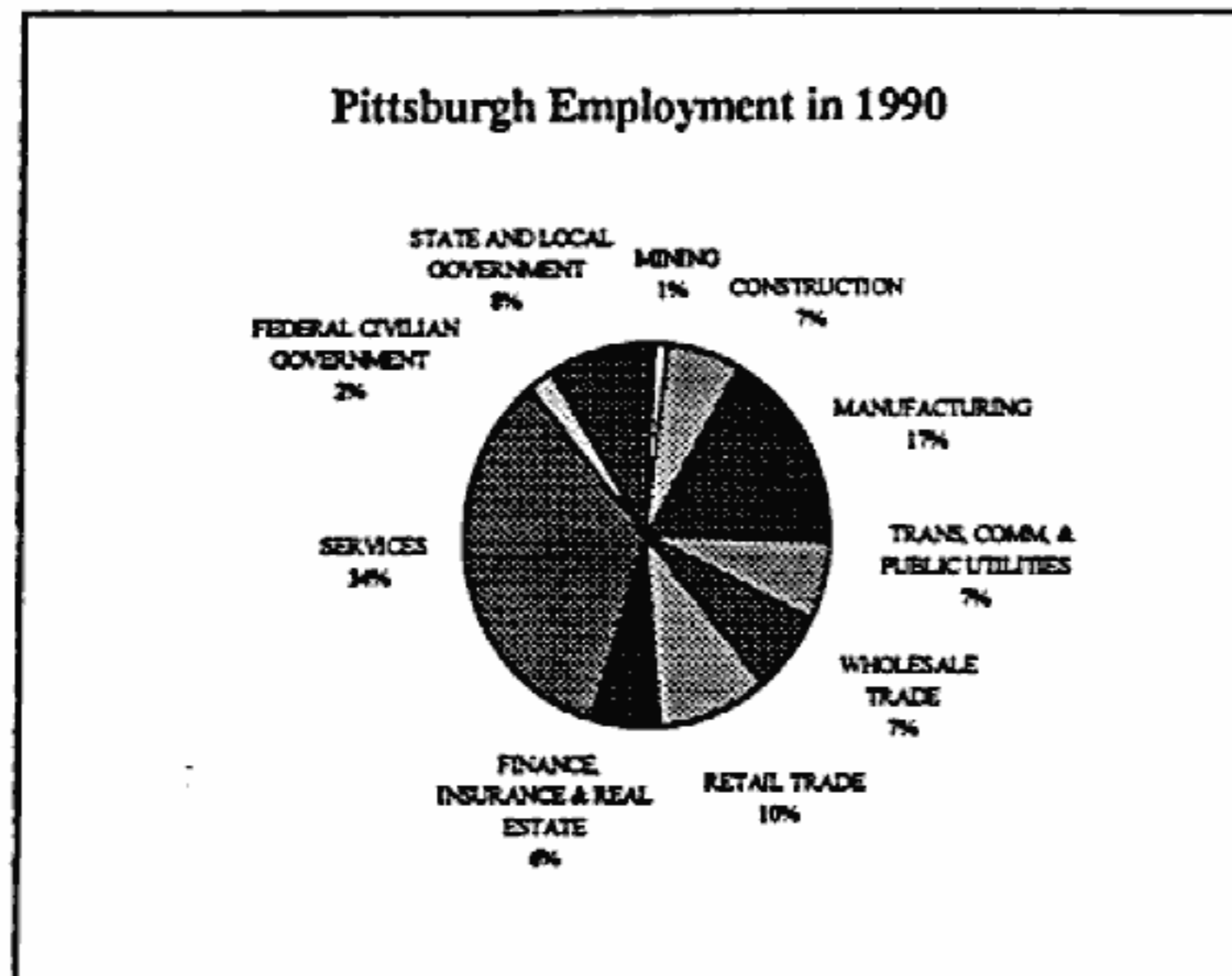
Moving Pittsburgh to a Win-Win Position

If Pittsburgh wishes to pursue sustainable development as a growth strategy, this region must look to regions which rank higher on both dimensions of our Index. Two key points are important to consider when thinking about Pittsburgh. The first is that, to achieve a good balance between economic and environmental factors, Pittsburgh must pursue a fairly complex and integrated initiative bringing together elements of the Competitive and Sustainable Regional model. The region must unite the community, labor, and management to design sustainable "win-win" strategies. The second key point centers around the concept of sustainability. Sustainability must be a focus of any growth strategy for Pittsburgh where economic and environmental goals are pursued simultaneously. Focusing on only one dimension at a time will eventually fail. This failure is exemplified in Pittsburgh's history with air pollution and the steel industry. High pollution levels were a result of a region more concerned with its steel industry than its environment. Pittsburgh has the potential to link its economic and environmental goals and may have a significant advantage in attaining them because of its solid base of environmental companies.

⁷ World Resources Institute. *The 1993 Information Please Environmental Almanac*. New York: Houghton Mifflin Company, 1993.

Pittsburgh's Economic Assets

Figure 14: Distribution of Employment, Pittsburgh, 1990



Pittsburgh has many regional assets. The city is home to corporate headquarters, banks, business law firms, accounting firms, and business service firms. In 1991, *Fortune* magazine rated Pittsburgh the "Third Best City for Business." It has a major philanthropic complex with more than \$4 billion in assets. The city is also home to a large concentration of corporate and university research and development entities, including a super-computer center, health care research centers and the Software Engineering Institute.

In 1990, only 17% of Pittsburgh's jobs were in manufacturing, and services

accounted for 34%. From 1970 to 1990, the Pittsburgh MSA experienced "the most severe manufacturing decline of any major metropolitan region in the country." Our region lost approximately 54% of its manufacturing jobs in this period. (See *Appendix D: Pittsburgh's Manufacturing Base* for a detailed overview of Pittsburgh's Manufacturing Assets)

Leveraging Pittsburgh's Clusters for Growth

Pittsburgh's priority remains economic competitiveness. Focusing on the environment alone will not provide the needed drive. Pollution prevention and environmental management can clearly be wedded to the region's evolving competitiveness strategy. Much recent work has contributed to the development of a bold new strategy for growth. The Regional Economic Revitalization Initiative involved businesses, government organizations, and individuals in setting an aggressive economic agenda for the region. A recent report produced by the Pittsburgh High Technology Council⁸ builds on this momentum. Five key clusters in the Pittsburgh region are identified as growth engines. These clusters are identified in Table 5. A closer look at these key clusters shows clear opportunities to integrate pollution prevention and environmental management into the region's competitiveness strategy.

Our region's economic base has major clusters in metals and chemicals. Nationally, these industries are actively moving to incorporate pollution prevention into their business strategies. Pittsburgh's regional cluster in environmental products and services can serve as a resource. This local environmental expertise can be married with Pittsburgh's metals and plastics clusters. In short, moving Pittsburgh to a Win-Win position involves drawing upon clusters widely recognized in the region. Integrating the economy and the environment can become a natural part of Pittsburgh's competitiveness strategy. Growing the economy in this way will create the momentum needed to put this region on the path to a win-win outcome.

⁸ Pittsburgh High Technology Council and the Southwestern Pennsylvania Industrial Resource Center. *Thinking Differently About the Region: Southwestern Pennsylvania's Manufacturing and Technology Assets*. November 1994.

Table 5: Key Industry Clusters

Key Industry Clusters in Southwestern Pennsylvania			
Key Industry Cluster	Employment	Number of Firms	1991 Annual Wages (in millions)
Metalworking	71,637	1,421	1,400
Chemicals and Plastics	27,865	794	374
Biomedical Technologies	134,024	5,062	3,464
Information and Communication Products and Services	38,473	1,219	1,305
Environmental Technologies	30,693	845	871

Furthermore, Pittsburgh has a strong environmental technology industry (See Table 5). This industry can be traced back to the historical efforts to clean up air and water pollution in Southwestern Pennsylvania. Modern expertise in the cluster includes the control and remediation technology and services required for traditional manufacturing. Yet this sector's expertise also increasingly encompasses the monitoring, assessment, and avoidance technology and services demanded by participants in the global marketplace. A growth industry in its own right, the cluster is increasingly called upon by and seeks to do business with regional companies. In short, the expertise of the established environmental product and services sector can be connected with other leading clusters moving toward world class environmental performance.

Environmental Opportunities in Metalworking

Metalworking is Pittsburgh's historic and leading industry cluster. The opportunities to link the environment and competitiveness in this cluster are immense. The fabricated metals, primary metals, and machinery and equipment industries are important components of this region's metalworking industry. Nationally these industries vary on how they invest in pollution prevention. Primary metals manufacturers' investments in production process enhancements are only one quarter the amount that the industry spends on end-of-pipe control technology. By contrast, fabricated metals and machinery and equipment manufacturers, on average, spend more on process enhancements than on end-of-pipe technology.⁹ Given these national variations, the Pittsburgh region has the potential to move ahead by wedding local expertise in pollution prevention with the strategies of competitive companies throughout the region.

While a range of regional companies do business in the metalworking cluster, one sector of particular interest is specialty steel production. Four firms which together account for 75% of the nation's production of specialty steel have facilities or are based in the Pittsburgh region. Environmental performance manifests itself in this sector through supplier relationships. For instance, the Gillette Corporation, a global company, does business in the region with Allegheny Ludlum, a specialty steel manufacturer. Gillette's high performance supplier requirements prompt the already outstanding metals producer to place increased importance on the environment. This relationship is but one example of how Pittsburgh's leading industrial cluster can tap into local expertise in environmental best practices.

Case Study 2: Company X

⁹ Ibid.

Company X is a local producer of heavy equipment for the construction and mining industry. This company has incorporated a strong environmental plan into its overall strategy, including efforts to reduce emissions with a goal of pursuing zero emissions. The two highest motivating factors behind the plan are: corporate citizenship and the needs of key customers. For most other companies it has been environmental regulation.

Company X's environmental program has focused on source reduction, recycling and less toxic alternatives beyond the minimum regulated. With respect to less toxic alternatives, *Company X* decided to limit ozone-depleting materials from its production process. It also requires suppliers to conform to those standards. The company welcomes participation from its R&D staff, engineers, customers, and suppliers in planning and discussing environmental strategies.

The top three environmental regulations affecting *Company X's* environmental strategy are: the Clean Air Act Amendments (CAAA), the Clean Water Act (CWA), and Superfund. *Company X* feels that the Clean Water Act is too restrictive, citing an example where it had difficulty finding water sources because they did not meet CWA requirements. This resulted in the relocation of the facility and the layoff of over 30 people. For cases related to Superfund, the company feels that it bears too much of the burden. For example, these cases cost the company time, lawyer fees, and potential development.

From this company's point of view, the biggest obstacle to growth in the Western Pennsylvania region is government regulation. For instance, there are many conflicting departmental standards within the government. A company representative cited a recent conflict over one of the company's reservoirs, where a government agency approached them demanding the reservoir be removed due to potential damage to the surrounding eco-system. Yet another agency stated that the reservoir was fine, as long as the company made some minor adjustments. These inconsistencies are very complicating for company operations.

Environmental Opportunities in Chemicals and Plastics

The region contains an estimated 125 firms involved in chemicals manufacturing, primarily concentrated in specialty chemicals, and another 175 firms in the plastics industry.

Growth is predicted in the specialty chemicals industry due to the focus on flexible and client-oriented production, both of which are characteristic of the New Competitiveness in general. In addition, the development of advanced plastics is also expected to create business opportunities. However, the growth of the chemical industry is currently constrained by environmental regulations. Both industries are being pressured to create environmentally safer products. Nationally, the chemicals and plastics industry invests about 13% of its total capital expenditures in pollution prevention. In 1991, this investment was 16 billion dollars. In 1993, less than a third of the pollution prevention investment made by the chemicals and plastics industry was made in production process enhancements.¹⁰ These national trends may provide a competitive opening for Pittsburgh. The location of the chemicals and plastics cluster and the environmental cluster together in this region can be used as a leverage point. Linking these industries provides the competitive advantage of the expertise in both clusters, which grows naturally from the concentration of these industries in this region.

Across the spectrum of Pittsburgh's key industrial clusters, opportunities exist to link environmental expertise and growth. The metalworking cluster and the chemicals and plastics cluster are industrial sectors which can move immediately to create this synergy.

Case Study 3: Company Z

¹⁰ US Bureau of Census. *Current Industrial Reports: MA200(93)-1; Pollution Abatement Costs and Expenditures, 1993..* Washington, DC: US Government Printing Office, 1994. Also used 1981-1991 reports

Company Z works with water-based materials and has five facilities in Western Pennsylvania. They consider that the most important factors affecting their environmental strategy are improving technology, corporate citizenship and increased productivity. This company has always tried to improve technology while maintaining the health and safety of their employees. According to the company, line workers contribute when new environmental policies are to be applied. In addition, suppliers contribute by providing emerging technology, new substances, more effective raw materials, and other assistance.

The management of this company does not consider increasing markets for green products to be a key factor affecting its environmental strategy. They feel that these factors do not have direct impact on business operations. Their pollution prevention strategy is based on recycling, production process improvements, and source reduction. In particular, water process improvement is the most important element of the company's pollution prevention strategy. The company is always looking for new technology in the water recycling industry. However, management believes that there is no such thing as zero emissions. Some contributors to their pollution prevention strategy feel that this goal violates the basic principles of thermodynamics.

The focus of *Company Z*'s technical management team is on environmental compliance. *Company Z* reduced its emissions by 22% last year. In fact, last year they were able to reduce 78.2% of the valuable organic compounds that the company produced 2 years ago. Over the next year they are expecting a 40% reduction in their emissions.

Company Z's representative thinks that sustainable development is a viable growth strategy for Western Pennsylvania. However, Pittsburgh needs to solve its economic problems first and then look to a sustainable development strategy for growth.

Pittsburgh Corporate Environmental Scorecard

To see how Pittsburgh's manufacturing companies compare to national corporate environmental best-practices, we sent the environmental best-practice survey, described in Chapter 3, to a sample of Pittsburgh-based companies. The goal of the survey was to determine if Pittsburgh firms are following national trends. The survey was sent to 174 local manufacturing firms, picked randomly from the Register of Manufacturers. A total of 48 firms responded, for a 27.6% response rate. Thirty firms indicated that pollution prevention was an important part of their environmental strategy.

Through our survey we hope to understand if companies are doing business differently. We consider the following key elements:

"why" -- what is the impetus for pollution prevention
"who" -- who within the firms are making decisions
"what" -- what are the innovations that are being undertaken.

In addition, the Pittsburgh survey was analyzed with an eye towards benchmarking local companies against national firms.

The survey results show that while Pittsburgh companies tend to lag behind their national counterparts, there are local companies which have undertaken some of the same innovations that national companies have, but not to the same extent. Indeed, there is a small core of firms in Pittsburgh which integrate pollution prevention into their overall business strategy.

A significance test, which examines whether the different answers come from the same or from different underlying populations, was performed on each response to the two surveys. For example, 39% of national companies rate pollution prevention as "very important" to their corporate performance, as opposed to 33% of local firms. The test shows that the two responses are not significantly different, meaning that no inferences may be drawn from the 6% spread. For Pittsburgh, the above example is good

news. It shows that there are firms here who have recognized that there are gains to be had from pollution prevention.

Pollution Prevention Strategies

For factors affecting environmental strategy, Pittsburgh firms show almost no significant differences from national firms. In other words, roughly the same percentages of local firms recognize the roles of improving technologies and increased productivity. The one area of significant difference was in citing "corporate citizenship" as an impetus for environmental strategy. On a scale of 1 to 4, where 4 is "very important" and 1 is "not important", Pittsburgh companies rated "corporate citizenship" on average 2.8 as opposed to 3.3 for national companies. One possible explanation for this response is that a large portion of respondents in the national survey were from the S & P 500 Index (i.e. giant firms which place a premium on public relations).

Scorecard		
	Pittsburgh Firms	National Firms
Pollution Prevention Very Important to Corporate Performance	√	√
Production Process Improvements	70%	87%

As for answering the question of what firms are doing, there were some differences in the answers of Pittsburgh and national firms. These differences are significant at the .10 level, meaning that we are 90% certain that there is a difference. Otherwise, the differences reported are significant at the .05 level, implying that we are 95% confident that there is a difference. Here, the results are mixed. Eighty-seven percent of national firms report that production process improvement is an element of their pollution prevention strategy as opposed to 70% of local firms. Yet fewer Pittsburgh firms report using treatment and end of the pipe control technology than national firms. As these latter two elements are representative of older forms of pollution prevention, the fact that fewer firms employ them should indicate that newer techniques (such as production process improvements) are being used. As the data presents a somewhat confusing picture, perhaps the most important result to highlight is the 70% of local firms using production process improvements. While this figure is lower than that for national firms, 70% is a significant amount and might indicate the sector upon which to rebuild the region's economic base.

Looking at specific production process improvements sheds more light on this issue. Pittsburgh firms cited both the conversion to closed loop or partially closed loop systems and the introduction of new process technologies at significantly lower rates than national firms. The two most common answers for Pittsburgh firms were "recycling" and "upgrade of existing process technologies." Still, there is a foundation for growth. Forty-three percent of the local firms introduced both new process and new product technologies.

Total Quality Environmental Management

Another question asks about the existence of a Total Quality Environmental Management (TQEM) program. Forty percent of national firms reported using TQEM as opposed to 20% of local firms.

Scorecard		
	Pittsburgh Firms	National Firms
Use of TQEM		√
R & D staff	√	√
Line Workers	√	√
Suppliers	√	√

As TQEM allows companies to examine their production processes and their intra-organizational structure

in detail, it is a very useful way of finding areas of improvement for environmental performance. Pittsburgh's lag on this score need not cause much concern, as the implementation of a TQEM program is not financially draining. Since TQEM programs are designed to produce a net return for the companies which implement them, this program is a potential area in which governmental or philanthropic assistance could be very useful.

One noteworthy point is that the actors listed as key in influencing environmental decision making were the same for Pittsburgh as for national companies. This similarity might indicate that while TQEM terminology may have not yet arrived in Pittsburgh, companies are generally employing the same strategies. Pittsburgh companies cite top management, R & D staff, engineers, and line workers as integral to their pollution prevention strategy. Additionally, 40% of local companies cite suppliers as key to these decisions.

Expenditures on Pollution Prevention

Pittsburgh companies lag behind their national counterparts in the level of company expenditures devoted to pollution prevention. Over the last fiscal year almost half (47%) of

Scorecard	Pittsburgh Firms	National Firms
1- 10% of Capital Expenditures Within Last Year Devoted to Pollution Prevention	47%	70%

Pittsburgh companies devoted between 1-10% of capital expenditures to pollution prevention, while more than two-thirds of national companies fit this description. As is discussed below, Pittsburgh companies see the lack of ready capital as a barrier to improving their environmental performance. Nevertheless, it must again be noted that Pittsburgh's lower score does not exclude the possibility of using sustainable development as growth strategy. Forty-seven percent of firms is certainly a large enough core of companies upon which to build.

Finally, these findings lead to more questions. Are there practices employed by some Pittsburgh firms but not by others? Do Pittsburgh firms which responded that pollution prevention was "very important" to their overall corporate performance behave differently than others? Similarly, are there differences between firms which do and do not cite suppliers as key to their environmental strategy? Are there differences in behavior between firms which have significantly reduced pollution and those which have not? The answers to these questions provide more insight into policy options for the Pittsburgh region.

Corporate Performance and Pollution Prevention

The survey asked Pittsburgh companies to rate how important pollution prevention was for their corporate performance. In this sense there are some differences between the group of firms which answered "very important" and those which answered less than "very important."

The companies who recognized pollution prevention as "very important" have looked to production process improvements and treatment more often as methods of pollution reduction than the group of firms who rated pollution prevention as less than "very important". More specifically, 80% of the "very important" respondents valued production process improvement as a main element of their environmental strategy versus 65% of the other group of firms. In the case of the use of "treatment" as an alternative, the "very important" group represents 40% as opposed to 20% for the other segment.

Case Study 4: Company Y

Company Y is a steel processing plant. According to this company, having an environmental strategy is a "cost of doing business." The top environmental regulations which affect their environmental planning are Title V of the 1990 Clean Air Act Amendments and the water standards imposed by the Pennsylvania Department of Environmental Regulatory (DER). The DER impact is felt most with the costs of permits to increase the level of discharge. The major factors affecting this company's environmental strategy are: improving technologies, regulations, corporate citizenship, competition from competitors, serving key customers, and increased productivity.

Environmental regulations are costs which are not seen as linked to increasing productivity. However, technological changes can also be environmentally friendly. For example, the EPA identifies chrome, a byproduct of the manufacturing process in this plant, as a "bad actor" in the environment. Consequently, this company has worked to minimize the leaching of chrome. They have employed an alternative type of chrome in their manufacturing that is not water soluble. This change also provides an improved product to their key customers. Market forces in general have little impact on their environmental strategy.

The company has a flat organizational structure. Therefore it is very easy to involve top management in all decisions. The company is also small enough that line workers and others are sought for their input to potential production changes. In effect, the company operates using a quality approach but without a Total Quality Environmental Management (TQEM) program. Its main goal is to just "keep the company out of trouble". The area where the company most extensively uses outside consultants and engineers is on environmental issues, where they rely on these outsiders' expertise in the regulatory world.

The biggest obstacle to improved productivity and environmental quality in this company, and in Western Pennsylvania, is the lack of investment capital. This plant currently operates at 100% capacity, seven days a week, 24 hours a day using equipment that is forty years old. The plant needs to upgrade its production process. Any increase in productivity, as well as any improvement in environmental quality, is limited by the age of the equipment. For example, the plant's present equipment uses water as a coolant and then discharges the waste outside the plant. Not only is the water wasted, but there is an increased cost because of the constant need for more water. By contrast, today's upgraded equipment uses water as a coolant and then re-circulates the water. The company would like to build a new galvanizing plant in Western Pennsylvania that uses this upgraded equipment to increase their productivity and environmental quality but needs investment capital to achieve this goal.

Differences seem to be larger between both groups when the firms explain in detail the specific production process improvements which play a significant role in their pollution prevention strategy. For 70% of the companies which answered "very important", the introduction of new product technology constitutes a key practice in pollution prevention. Meanwhile, this introduction is a key practice for only 30% of those firms which answered less than "very important." Another practice, conversion to closed loop systems, is also a specific practice used by 50% of the "very important" group as opposed to 20% of firms which answered less than "very important."

Firms who rate pollution prevention as very important to their corporate performance are more likely than others to:

✓ Use new product technology

✓ Use Closed Loop

✓ Use TQEM

✓ View Both Customers and Line Workers as Key to Their Environmental Decision Making

The pursuit of zero emissions standards and the application of TQEM practices is more likely to be practiced among companies which recognized pollution prevention as a "very important" element of their corporate performance. Ten percent of the companies who answered "very important" are pursuing zero emissions as opposed to 0% of the those rating pollution prevention as less than "very important". In the case of TQEM programs, the distribution is 30% to 15% respectively. Finally, firms which rate pollution prevention as "very important" to their corporate performance cite line workers (80% versus 55%) and customers (70% versus 25%) as key players in their pollution prevention strategy.

Large Emissions' Reducers

Locally, an aggressive pollution prevention program does appear to have had an effect. The Pittsburgh companies which have decreased their pollution emissions by more than 10% rated pollution prevention as "very important" to corporate performance. However, firms which achieved a decrease in their emissions of 0-10%, also valued pollution prevention as "important".

Firms which decreased more than 10% of their emissions paid more attention to the introduction of new product technology than firms which decreased emissions by less than 10% (53% versus 27%). However, more than 80% of the companies which decreased emissions by less than 10% cite the upgrading of existing process technologies as playing a significant role in their environment strategy.

All the companies which decreased their emissions by only 0-10% are pursuing reduced emissions standards. Some of the firms (5.3%) with emission reduction levels of more than 10% are pursuing zero emissions standards. The same happens with the existence of TQEM programs: 26.3% of the companies with emission reductions of greater than 10% have TQEM practices in place as opposed to 9% of the other group of firms. With regard to firms' pollution prevention strategy, the most significant difference between companies which reduced their emissions by more than 10% and those which did not was that line workers are key players for 73.3% of firms versus 45.5% respectively.

However, engineers are key actors more frequently in companies with emissions reduction of less than 10% than in those firms which achieved greater levels of reductions (73% and 47%).

Firms who reduced pollution by more than 10% over the last fiscal year are more likely than others to:

✓ Use new product technology

✓ Pursue Zero Emissions

✓ Use TQEM

✓ View Line Workers as Key to Their Environmental Decision Making

Pittsburgh vs. National Key Findings

The survey of Pittsburgh firms indicates that local firms are not far behind the national averages in terms of innovation and pursuit of environmental initiatives. Interestingly, the profiles of Pittsburgh's innovative firms are very similar to those of national firms. A comparison of Pittsburgh and national firms which view pollution performance as "very important" to corporate performance will show great similarities. There is a core of businesses here which are pursuing environmental innovations in ways similar to national firms. This core is probably of sufficient size to serve as a foundation for a regional strategy.

Emerging Initiatives

An aggressive strategy for growth is already underway in the Pittsburgh region. Yet, organizations throughout the region cannot stand alone as they work toward economic growth. The challenge is to coordinate and link the enormous energy in the region to the emerging competitiveness strategy. The linkage of environmental management with pollution prevention provides a positive direction for the evolving competitiveness strategy of the Southwestern Pennsylvania region, constituting an enormous growth opportunity for Pittsburgh's key clusters.

Attempting to provide full justice to current economic initiatives in Pittsburgh falls beyond the scope of this review. A static picture of the current environment cannot capture the rapid changes and additions to organizational activity now being generated in the Pittsburgh region. Our intention is to give

examples of current activity which seek to link Pittsburgh's manufacturing base with opportunities for environmental improvement. A number of prominent Pittsburgh organizations associated with linking the environment and economic growth are listed in Table 6. What follows should be viewed only as a sampling of the specific initiatives underway in the region.

Table 6: Sample List of Pittsburgh Organizations

Linking the Economy and Environment: Examples of Organizations in the Region
Allegheny County Department of Regional Planning
Allegheny Policy Council for Youth and Workforce Development
American Institute of Architects—Committee on Environment
Business for Social Responsibility
Center for Hazardous Materials Research
City of Pittsburgh—Department of City Planning
Community College of Allegheny County
Conservation Consultants, Inc.
Green Building Alliance
Green Design Initiative at Carnegie Mellon University
GRIP (Group for Recycling in Pittsburgh)
Heinz Endowments
Hill Community Development Corporation
IBACoS (Integrated Building and Construction Systems)
Institute for Local Self Reliance
Mon Valley Initiative
PHASE
Pittsburgh High Technology Council—Environmental Business Network
Pittsburgh Allegheny Empowerment Partnership
Regional Economic Revitalization Initiative
Slippery Rock University
South Side Local Development Corporation
Southwestern Pennsylvania Industrial Resource Center (SPIRC)
Steel Valley Authority
Susquehanna Project
Western Pennsylvania Sustainable Energy Group

Creating Synergy Across the Clusters: Environmental Business Network (EBN)

One initiative in the Pittsburgh region is the Environmental Business Network, housed at the Pittsburgh High Technology Council and formed in 1994. The EBN concept developed as a result of recent intensive growth of the environmental products and services companies in Southwestern Pennsylvania, but EBN is not limited to these companies alone. It organizes workshops and peer exchanges on leading-edge technologies, often in concert with area organizations such as the Center for Hazardous Materials Research. These workshops are intended not only for the cluster companies but also for the wide range of regional businesses which are interested in incorporating the environment into their business strategies. In addition, EBN is putting together programs to link students at local colleges and universities to the base of manufacturing employers in the region. For example, a joint training program for environmental technicians was recently conducted at the Community College of Allegheny County. The program drew on the expertise of the Center for Hazardous Materials Research in putting together its curriculum, which in turn prepares graduates for employment in this cluster in the region.

Sustainable Valleys Project

Another regional initiative is the "Sustainable Valleys Project" of the Steel Valley Authority. The SVA has long been working on manufacturing retention in the region, consistently focusing on mill site redevelopment over the past several years. Now, to augment these efforts, the SVA's new project seeks to incorporate the environment into redevelopment. One facet of this strategy provides environmental technical assistance to the wide range of manufacturers in a twenty-county area in Southwestern Pennsylvania. The local side of this strategy targets the development of a "Green Industry Park." This initiative attempts to create an economically viable materials collection infrastructure, intended to support manufacturing operations located on available mill sites. The Institute for Local Self Reliance, a Washington, D.C. based national nonprofit organization, has also been working with the SVA on this initiative.

Citizen Housing Initiatives

The region's complex of community development corporations and nonprofit organizations is working together on housing initiatives. For instance, the South Side Local Development Corporation, Slippery Rock University and Conservation Consultants, Inc. are three of many participants working on developing energy efficient housing in Pittsburgh and the surrounding area. One project involves the development of a showcase block on the South Side intended to set quality standards for housing construction. This showcase is intended to serve as a model and to anchor a future larger, private, multi-block development. Other examples of organizations participating in energy efficient housing design and construction projects cannot be profiled in the limited space available here. Suffice to say, numerous examples would be needed in to draw a comprehensive picture of innovative housing activity in the Pittsburgh region.

These regional efforts are an important step toward achieving synergy between the environment and economic development. In order to move the Pittsburgh region further down this path, the following section outlines a series of strategic recommendations for linking the environment to regional competitiveness.

Strategic Recommendations

Chapter 5 : Strategic Recommendations

The Pittsburgh region has a long and distinguished history as an innovator in economic development and environmental restoration. The challenge that remains is how to position the Pittsburgh region for a bright and prosperous future in the twenty-first century. To that end, we offer the following strategic recommendations which we believe will build upon the legacy of past efforts, including the renowned Pittsburgh Renaissance, and help to ensure the region's sustainable competitiveness.

Our recommendations need not be seen as a blueprint or prescription for change. Rather, they are a series of options for linking the environment to the region's emerging vision for competitiveness. It is in this spirit that we offer the following three recommendations for making Pittsburgh a competitive and sustainable region.

Make Environment Part of the Region's Emerging Competitiveness Effort

To be successful, the environment must be seamlessly integrated into the region's emerging competitiveness strategy outlined in a number of recent efforts, such as the Regional Economic Revitalization Initiative. As discussed in Chapter 4, Pittsburgh is currently developing an aggressive portfolio of environmental projects and has a strong base of citizen-related and residential environmental activities. As also seen in Chapter 4, there is some movement in Pittsburgh towards viewing environmental advances as part of broader economic gains.

Environmental improvements by themselves, however, will be of only very limited effectiveness. For these environmental efforts to be effective, they will have to be tied to the region's broader economic agenda. Environmental efforts will succeed to the extent that the region's business and citizenry see that they are part of a broader strategy of economic growth, competitiveness, and job creation.

• Strategic Recommendations

- Develop close links between economic competitiveness strategies and the region's emerging environmental initiatives.
- Leverage the historical reputation of the Pittsburgh Renaissance as the rallying point for making Southwestern Pennsylvania a model of a sustainable and competitive region.
- Market Pittsburgh as an attractive region to high-performance manufacturers and those pursuing zero defect, zero inventory, and zero emissions strategies (Z³). Use the existing base of successful, innovative, local companies to drive this campaign.

Emphasize Win-Win Outcomes

For the environment to be a successful and integrated part of the region's emerging competitiveness effort, Pittsburgh must emphasize win-win opportunities which simultaneously increase both economic and environmental performance. For much of our past, economic development and environmental improvement have been seen as conflicting goals. During Pittsburgh's early growth years, the environment was needlessly neglected, as exemplified by the slogan "smoke equals progress." More recently, the environment has come to be seen as an impediment to economic growth and job creation. When mills were

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Appendices

Appendix A: Competitive And Sustainable Regions

Overview

Regional analysis was undertaken to discover leading economic and environmental practices around the world. Five regions were studied in detail. Our approach focused on basic analysis of regional economies, identification of sustainable initiatives and their drivers, and a comparison of the initiatives on a variety of dimensions.

The five observed regions were selected for varied reasons. Three of the five regions were chosen for their similarities to Pittsburgh. In the case of Chattanooga, Hamilton, and Kitakyushu, the regions shared a common background. All had a history of heavy industry, inflicting serious damage on the local environment. The regions had also experienced structural economic shifts away from heavy industry and had accomplished successes in cleaning up their local environment. Seattle does not truly fit the preceding description, but was included as an example of a healthy, growing region which is nevertheless giving more attention to its environmental quality.

Through this analysis was obtained new and unique information by direct contact with key representatives of government, business, environmental organizations, and economic development organizations. From this information we have drawn patterns which have provided the foundations for our Competitive and Sustainable Regional Model.

Chattanooga, Tennessee: The Environmental City

In the late 1960's, Chattanooga earned the dubious distinction of being one of the nation's most polluted cities. A center of heavy industry, including automotive products, textiles, nuclear reactor construction and steel, the Chattanooga region had severe problems with air quality and with the pollution of Chattanooga Creek and the Tennessee River.

Since that time, the city has gone through a major transition. Faced in the 1970's with not only its pollution problems but a shrinking industrial base, the city launched itself on a process of rebirth. A goal-setting process dubbed Vision 2000 was initiated with the support of local governments and private sector leaders. The goals set by this coalition included a variety of economic development and quality of life objectives, as well as some objectives for improving the city's environmental quality. The goal setting process yielded strong results in the late 70's and 1980's, and a second goal-setting process was initiated, receiving strong support from every sector of the community. This second goal-setting process was significant in steering the city down a path of economic development which emphasized sustainability.

During the 1980's and 1990's, a broad-based effort to recast the city's image as "The Environmental City" has yielded some positive results and continues to have strong momentum. The Chattanooga Chamber of Commerce, city government officials, community groups and others have joined together in this initiative. Some of the high points of the sustainability initiative include the remediation of the city's environmental resources, efforts to hold industry more accountable for its environmental impact, and efforts to stimulate new industries which produce environmental products and services. The primary targeted industries are the electric bus industry and the water quality improvement industries.

The city is also reexamining its human capital infrastructure, in an effort to improve the quality of education in Chattanooga and the surrounding county. Current initiatives are underway to reorganize the city's school system for this purpose.

The most tangible of Chattanooga's achievements toward sustainability can be seen along its river front. There a freshwater aquarium and a river front park attract thousands of visitors, while electric shuttle buses bring them there. Plans are underway for the redevelopment of the city's South Central Business District. This plan includes zoning for zero-emissions industry, the development of eco-industrial parks and new R&D facilities in addition to commercial and residential property. The planning process was led by a public-private partnership known as River Valley Partners.

Other initiatives of note in Chattanooga include the creation of the International Congress of Environmental Commerce and Technology, a coalition spearheaded by Chattanooga State Community College, with the involvement of regional and international businesses and research labs. ICONECT has as its goal the development of market niches for business in the Chattanooga region which produce environmental products and services.

Hamilton, the Sustainable Region

Hamilton is a municipality of 452,000 located in the western end of Lake Ontario, Canada. Its area is about 1,120 square kilometers and the municipality budget is around US\$ 400 million. The main economic activity is manufacturing, with a shift to service industries such as education, health services, business services, insurance, real estate and finance. Hamilton has been undergoing a major economic transition since the 1980's when the steel and heavy industry manufacturers began to reduce their local operation. The losses in jobs have been around 1,000 a year over the last 10 years.

In 1980's, Hamilton began cleaning its harbor from decades of industrial and municipal pollution. It was the first of 57 'environmental hot spots' in the Great Lakes system to complete its "Remedial Action Plan" under the US- Canada Great Lakes Water Quality Agreement. Based on that experience, the Hamilton Regional Chairperson created a special Task Force on Sustainable Development in 1989. After 3 years of work, the task force developed three reports: "Vision 2020 - The Sustainable Region", "Directions for Creating a Sustainable Region", and "Detailed Strategies and Actions for Creating a Sustainable Region".

The reports were adopted by the Regional Council as a guide to all future decision making. Additionally, a Renaissance report that incorporates sustainable principles into community economic development activities was adopted as strategic plan for long-term economic development. The Staff Working Group on Sustainable Development was mandated to develop mechanisms for integrating the principles of sustainable development and the vision statement into the process of the capital budget and departmental work programs.

At present, the region is implementing almost a 100 of the 400 recommendations made in the "Vision 2020" reports. These recommendations focus on different key issues such as the identification of potential key sectors for economic growth, programs to support the generation of environmental business, research programs on environmental issues, information systems and consortia, land use and health policies, among others. At present, the Regional Council, jointly with the International Council for Local Environmental Initiatives and McMaster University's Environmental Health Program and Health of the Public Project, is addressing efforts on measuring Hamilton's efforts in relation to the goals of "Vision 2020".

The local government is one of the main drivers of the sustainable initiative in Hamilton. The municipality of Hamilton is continuously organizing activities and programs to gather different stakeholders. As well as it provides support to private initiatives and encourage the creation of partnerships among the local government, business and academic sector, and community groups. Examples of this are the creation of the Greater Hamilton Technology Enterprise Centre (GHTC), and of private/public joint-ventures such as the partnership between the Region and the Philip Utilities Management Corporation to operate water and wastewater treatment facilities.

This initiative is also heavily based on community participation and consultation. Community forums, meetings and workshops were held to incorporate the population's preferences and needs in the planning process. Also, community activities such as the Sustainable Community Day and outreach programs are central in the overall sustainable initiative.

The academic sector is involved through major research activities. The Eco-Wise project is an interdisciplinary environmental research project involving a number of partnerships with government agencies and community groups. The participation of the academic sector is also reflected in the training of the human capital in programs such as the Sustainable Development Certification Program.

Finally, the business sector is responding to this initiative. There are good examples of firms that are taking the lead in the implementation of pollution prevention and production process improvement. Wastewater management and steel specialty are among the sectors in which good advances can be seen. The sustainable initiative is also looking for the participation of small firms and, in this sense, the local government provides consulting services to help firms comply with environmental regulations.

Sustainable Seattle

Sustainable development initiatives in Seattle are focused on the maintenance of environmental quality in both the city of Seattle and the Puget Sound Region. Leadership on the sustainability issue comes primarily from multi-level government. With the inaction of the Washington State Growth Management Act, the State of Washington has voiced a commitment to managing the region's healthy growth, including its environmental impact. In response, Seattle city government recently adopted a comprehensive development plan entitled, "Toward a Sustainable Seattle." This growth plan focuses on development which will lead to greater use of mass transportation, and will create development patterns which reinforce communities and protect the environment.

Paired with the City's comprehensive plan is an Environmental Action Agenda also set by the city. The EAA has set up 10 goals for preserving and improving Seattle's environment. These goals include attention to air, water and noise pollution, efforts to cut down on the use of the automobile, conservation efforts, and efforts to minimize the negative environmental impact of the city's government operations. Primarily, the Environmental Action Agenda is geared towards changing the behavior of individual citizens and business with respect to the environment, but does not focus on changing industrial practice. Sustainable Seattle, a civic forum which includes government, some local business, and community groups, has developed a set of Indicators for a Sustainable Community. These indicators are meant to serve as a measuring stick for the city on a variety of dimensions. The indicators measure sustainability in not only an environmental respect, but also with consideration of social issues such as voter participation, exposure to the arts, participation in community service, and others. The indicators are currently being revised by Sustainable Seattle.

Sustainability initiatives in Seattle tend not to enjoy the consistent support of major local industries. Although Boeing is represented in Sustainable Seattle, coalitions of supporters for sustainable development have had trouble courting the consistent support of major local industries.

Kitakyushu, Japan: From "Gray to Green" to "Green to Growth"

Kitakyushu is located in the western part of Japan, embracing 482.23 square kilometers and 1 million citizens (1,027,455 as of 1990). Kitakyushu has been industrialized as one of 4 Big Industrial Zones, along with Tokyo-Yokohama, Osaka-Kobe, and Nagoya, since 1889. Kitakyushu had been called Japan's "Steel Capital." Manufacturing is main business sector in Kitakyushu, although the percentage of workers in manufacturing decreased from 29.2 % in 1965 to 20.1 % in 1990. The most notable feature of sustainable development in Kitakyushu is strong partnership between government, business, community, and academia.

In 1960's this city experienced severe pollution, giving its waters the title "Sea of Death," leading its air to be known as rainbow-colored smoke, and earning it a reputation as the most polluted city in Japan. The city spent years dredging more than 350,000 cubic meters of sludge from the base of its bay, heavily contaminated with mercury (over 30 ppm). The city also adopted the most severe environmental standards in the. Polluting companies also made efforts to develop pollution-prevention process and technology in an effort to comply with the new standards. There were citizen-driven environmental awareness initiatives, and integration of the knowledge and power in all sectors including universities.

During its environmental cleanup period, the city endured a long recession, dubbed "Cold Iron." From 1986 to 1987, the Kitakyushu Junior Chamber (KJC) visited Pittsburgh several times, bringing back to Japan the lesson of Pittsburgh's experiences in the 1940's, and making that lesson known to those in Kitakyushu. As a result, the "Pittsburgh Boom" took place and a private organization called KPEC was established with the support of the private sector and the communities. More than 800 companies and many citizens donated to KPEC, among them the Kitakyushu Chamber of Commerce and Industry, and the Industry Club of West Japan. After a series of discussions with citizens, the city adopted a long-term revitalization initiative known as the Kitakyushu Renaissance. Targeting the year 2005 as its goal for completion, the Renaissance plan had leadership from both the public and private sectors.

It is important to understand that "Renaissance" was taken to mean neither the simple clean-up of the city nor simply urban revitalization. Rather, the goal of the Renaissance was to achieve Kitakyushu's revival as a world industrial city. This approach lays the foundation for Kitakyushu's perception that sustainability is closely linked to competitiveness. Under this vision, economic revitalization was emphasized along with improvement of environmental quality. The city recognized itself as the world's gateway to East Asia, and launched a series of projects to reinforce the city's transportation, industrial, and commercial infrastructures such as the Techno-Center, and the Asia-Pacific Import Mart, a public-private venture.

In the environmental arena, Kitakyushu has made efforts to make itself an international hub by transferring the industrial and environmental technology accumulated in the city to developing countries. In 1980, the Kitakyushu KJC, the Chamber of Commerce and Industry, and the Industry Club established the Kitakyushu International Techno-cooperative Association (KITA), which has contributed to the realization of "sustainable development" in developing countries.

In June of 1992, the United Nations Conference on the Environment and Development awarded Kitakyushu Local Government Honors at the Earth Summit in Rio, crediting the city's transformation from the 'Sea of Death' to a city of international environmental leadership.

Two figures below illustrate models of features typically shown in Kitakyushu: integrated functions and integrated sectors.

Exhibit 1: Model of Integrated Functions

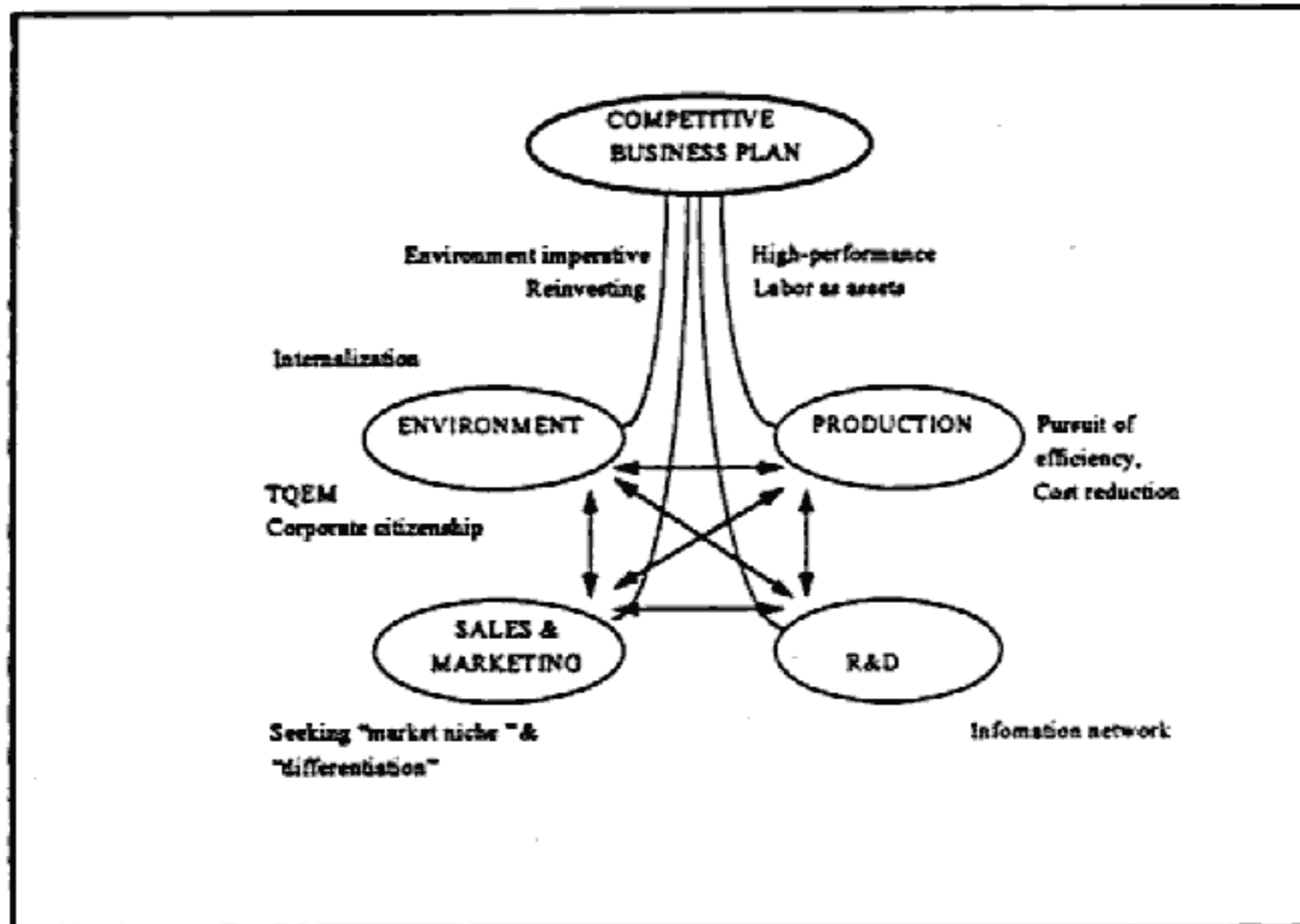
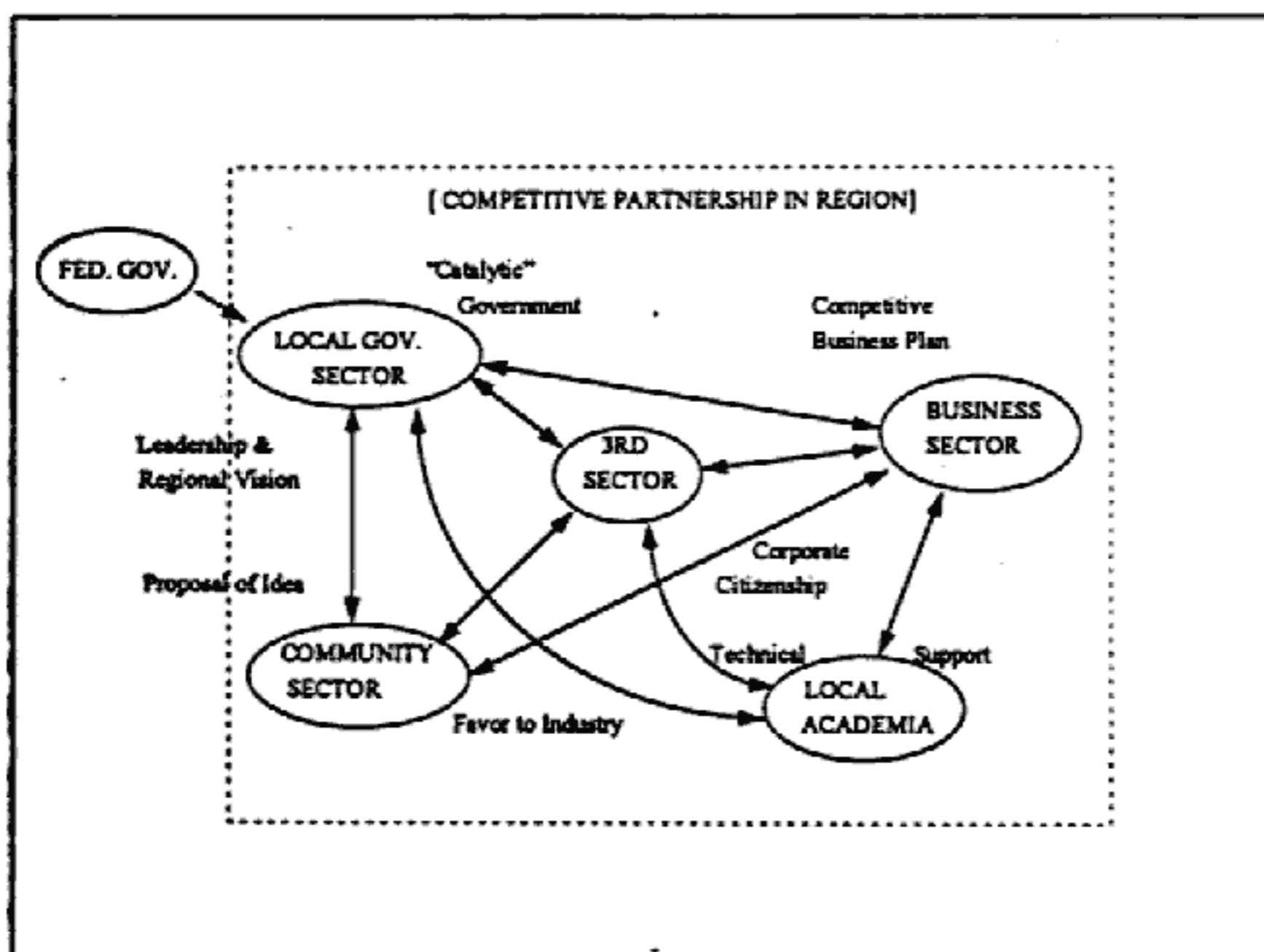


Exhibit 2: Model of Integrated Sectors



Appendix B: Investment in Pollution Abatement and Control

In general the trend over the last decade has been increasing expenditures on pollution abatement. The importance of this investment can be seen by looking at PACE's share of total capital expenditures. For all manufacturing industries in 1991 (the data is not available to make the calculation for 1993 yet), PACE comprised about 8% of all capital expenditures. For some industries, such as petroleum (25%), paper (14%), and chemicals (13%), PACE's share of capital expenditures was much higher.

1991 Pollution Abatement Expenditures and Operating Costs by Industry

		Pollution Abatement & Control:				
<u>SIC</u>	<u>Year</u>	<u>Total Capital Expenditures</u>	<u>Capital Expenditures (PACE)</u>	<u>Operating Costs (PAGC)</u>	<u>PACE Share of Total Capital Expenditures</u>	
20	Food	1991	9361.90	481.80	1254.20	5%
21	Tobacco	1991	405.30	5.90	48.40	1%
22	Textile	1991	2109.40	56.80	213.70	3%
24	Lumber	1991	1573.20	141.20	298.40	9%
25	Furniture	1991	728.80	23.70	136.20	3%
26	Paper	1991	9008.70	1232.60	1635.00	14%
27	Printing	1991	5041.40	37.20	228.10	1%
28	Chemicals	1991	16008.70	2066.10	4046.90	13%
29	Petroleum	1991	5895.90	1462.50	2849.00	25%
30	Rubber	1991	4214.70	81.70	440.90	2%
31	Leather	1991	99.50	15.00	45.90	15%
32	Stone	1991	2381.30	154.40	464.90	6%
33	Primary metals	1991	5878.70	673.40	2002.60	11%
34	Fabricated metals	1991	4071.60	176.90	842.60	4%
35	Machinery/equip	1991	7334.30	128.40	573.90	2%
36	Electronic	1991	8121.20	233.70	833.00	2%
37	Transportation equip	1991	10646.90	301.40	1118.30	3%
38	Instruments	1991	4489.50	104.40	280.00	2%
39	Misc.	1991	<u>822.10</u>	<u>13.10</u>	<u>74.90</u>	<u>1%</u>
	TOTAL	1991	98193.10	7390.20	17386.90	8%

Source: US Bureau of Census. *Current Industrial Reports: MA200(93)-1; Pollution Abatement Costs and Expenditures, 1993*. Washington, DC: US Government Printing Office, 1994. Also used 1981-1991 reports.

Capital expenditures are divided into either expenditures on end-of-line structures and equipment or on expenditures on production process enhancements. Our contention is that innovative firms focus on minimizing waste in the production process, rather than capturing or treating it at the end of the pipe. A strategy which invests in making improvements to the production process and in eliminating waste throughout the process rather than just the end of it, is fundamental to the new model. These firms see pollution prevention as a means for improving productivity and product quality rather than just as an additional cost. The 1993 PACE survey breaks out these two types of capital expenditures. Because of the very nature of investment in process enhancements, it should become increasingly difficult to sift out which

of these expenditures are attributable to pollution prevention, as firms move toward an integrated approach of continuous improvement in both economic and environmental performance.

The table above provides the breakdown of PACE by expenditures on end-of-line (EOL) control technology or on production process enhancements (PPE), by media for all industries and also by industry for all media. The ratio provided in the last column indicates how expenditures on PPE compare to expenditures on EOL. A ratio of greater than one indicates that there is more investment in PPE than in EOL. Overall, PPE expenditures are about 83% of the size of EOL expenditures. It seems that for air pollutants, more firms are moving towards investment in production process enhancements. PPE expenditures are 29% higher than EOL expenditures for air. For water, PPE expenditures are only 37% the size of expenditures on EOL. The technical factors of reducing wastes to water may be a critical issue here. Or, it may be more difficult to identify those process enhancement expenditures made specifically for the objective of reducing water pollutants.

Pollution Abatement Capital Expenditures by Abatement Technique, 1993
End of Line (EOL) or Production Process Enhancement (PPE)
in millions of dollars

		<u>EOL</u>	<u>PPE</u>	<u>Total</u>	<u>Ratio</u> <u>PPE : EOL</u>
All Industries	Air	\$ 1798.0	\$ 2324.0	\$ 4122.0	1.29
All Industries	Water	1678.1	616.8	2294.9	0.37
All Industries	Solid/Cont. Waste	453.6	307.3	760.9	0.68
All Industries	All Media	\$ 3929.7	\$ 3248.1	\$ 7177.8	0.83
20	Food	\$ 162.5	\$ 57.4	\$ 219.9	0.35
21	Tobacco	d	d	d	d
22	Textile	26.7	13.1	39.8	0.49
24	Lumber	56.1	17.7	73.8	0.32
25	Furniture	13.4	26.4	39.8	1.97
26	Paper	348.1	367.5	715.6	1.06
27	Printing	28.2	10.2	38.4	0.36
28	Chemicals	1376.7	581.2	1957.9	0.42
29	Petroleum	1048.0	1600.6	2648.6	1.53
30	Rubber	35.4	27.8	63.2	0.79
31	Leather	16.2	2.0	18.2	0.12
32	Stone	52.3	65.7	118.0	1.26
33	Primary metals	347.1	95.1	442.2	0.27
34	Fabricated metals	47.7	55.2	102.9	1.16
35	Machinery/equip	35.5	69.4	104.9	1.95
36	Electronic	124.3	52.5	176.8	0.42
37	Transportation equip	143.5	134.0	277.5	0.93
38	Instruments	49.4	55.6	105.0	1.13
39	Misc.	10.1	2.9	13.0	0.29

Source: US Bureau of Census. *Current Industrial Reports: MA200(93)-1; Pollution Abatement Costs and Expenditures, 1993..* Washington, DC: US Government Printing Office, 1994. Also used 1981-1991 reports.

Overall, it is important to understand the nature of expenditures on environmental strategies. A central element to the new model is the integration of environmental and economic goals. Sound investments on pollution prevention which enhance productivity and quality, and which reduce waste rather than treating or capturing it at the end of the production process are critical to the successful integration of environmental and economic goals. The trends in PACE illustrate that manufacturers in the United States have begun the move from end-of-line control technology to innovative changes in the production process as a means for meeting environmental goals while improving the firm's overall performance.

Appendix C: Benchmarking Innovative Business Practices

This team will identify regional and national companies in the manufacturing sector that use innovative business approaches with respect to cost and pollution reduction. A combination of research via a literature review, a survey, phone interviews, and site visits will be used to benchmark the pollution prevention initiatives of local companies against national firms.

Fax Survey Methodology

National Fax Survey

The participants for our national fax survey comes from three sources: the S&P 500, the S&P midcap 400, and the S&P smallcap 600. All the companies were randomly chosen manufacturing firms. The three sources were used because the goal is to project trends of top companies across the nation. The national fax survey was sent twice: the first time, to all 450 companies, and the second time to all those who failed to respond. Table I below summarizes: 1) the number of firms from each source that was sent a survey; 2) the number of faxes that did not get through to the firms; and 3) the total number of successful faxes sent.

Table I: National Fax Survey

<i>Source (National)</i>	# of Companies Selected
S&P 500	250
S&P midcap 400	100
S&P smallcap 600	100
TOTAL	450
<i>Number of Failed Faxes</i>	<i>116</i>
Total Number of Successful Faxes	334

The following Table (II) outlines: 1) which source the respondents come from; and 2) the response rate. A total of 99 firms responded to our survey; this resulted in a 30% rate of response.

Table II. National Response Rate

<i>Source</i>	TOTAL # of COMPANIES	%
S&P 500	45	45%
S&P midcap 400	38	38%
S&P smallcap 600	15	15%
TOTAL	99	100%
<i>Response Rate</i>	<i>99/334 = 30%</i>	

Pittsburgh Fax Survey

The participants for our Pittsburgh fax survey comes from one main source: Pennsylvania Manufacturers Register, 1992. All the companies were randomly chosen manufacturing firms. The fax survey was sent twice: the first time, to all 450 companies, and the second time to all those who failed to respond. Table III below summarizes: 1) the number of firms that was sent a survey; 2) the number of faxes that did not get through to the firms; and 3) the total number of successful faxes sent.

Table III. Pittsburgh Fax Survey

<i>Source (Pittsburgh)</i>	<i># of Companies Selected</i>
RPMF	252
<i>Number of Failed Faxes</i>	46
Total Number of Successful Faxes	206

The following Table (IV) outlines: 1) the total number of respondents; and 2) the response rate. A total of 30 firms responded to our survey; this resulted in a 15% rate of response.

Table IV. Pittsburgh Response Rate

<i>Source</i>	<i>Total # Of Companies</i>
RPMF	30
<i>Response Rate</i>	$30/206 = 15\%$

National Survey Results (No Pittsburgh Firms Included)

Q.2 How important is pollution to your overall corporate performance?
(1= not important; 4= very important)

<i>Importance</i>	<i># of answers</i>	<i>%</i>
Not Important	2	2%
Somewhat Important	16	16%
Important	38	38%
Very important	39	39%
No Answer	1	1%

Q. 3. Factors affecting the company's environmental strategy
(1= not important; 4= very important)

<i>Factors</i>	<i>Importance (average)</i>
Improving technologies	3.0
Increasing market for "green" products	2.1
Regulations	3.3
Pressures from environmental groups	1.8
Corporate citizenship	3.3
Competition from competitors	2.1
Serving key customers	2.8
Increased productivity	2.9

Q. 4. What are the main element(s) of your pollution prevention strategy?

<i>Elements</i>	<i># of answers</i>	<i>%</i>
Facility downswing	4	4%
Treatment	49	49%
Source reduction	88	89%
Recycling	84	85%
Production process improvement	86	87%
End of pipe control tech	23	23%
Other	8	8%

Q. 5. What specific production process improvement(s) have played a significant role in your pollution prevention strategy?

<i>Production process improvements</i>	<i># of answers</i>	<i>%</i>
Conversion to substitute fuels	22	22%
Recycling	74	75%
Introduction of new product technology	46	46%
Conversion to closed or partially closed loop systems	50	51%
Upgrade of existing process technologies	75	76%
Introduction of new process technologies	66	67%
Other	5	5%

Q. 6. Is your organization pursuing reduced or zero emission standards?

<i>Emission Standards</i>	<i># of answers</i>	<i>%</i>
Reduced	78	79%
Zero	12	12%
Not applicable	10	10%

Q. 7. Which of the following actor(s) play a key role in your pollution prevention strategy?

<i>Actors in pollution prevention</i>	<i># of answers</i>	<i>%</i>
Top management	84	85%
R&D staff	56	57%
Engineers	76	77%
Line Workers	62	63%
Suppliers	45	45%
Distributors	5	5%
Consultants	28	28%
Environmental organizations	21	21%
Customers	35	35%
Other	8	8%

Q. 8. Does your organization have a Total Quality Environmental Management program in place?

<i>TQEM</i>	<i># of answers</i>	<i>%</i>
Yes	40	40%
Not applicable	5	5%

Q. 9. What percentage of your capital expenditures was devoted to pollution prevention in the past fiscal year?

<i>Capital expenditures</i>	<i># of answers</i>	<i>%</i>
0%	0	0%
1-10%	70	71%
11-25%	8	8%
26-50%	2	2%
51-100%	0	0%
Not applicable	11	11%
No answer	7	7%

Q. 10. What percentage decrease in pollution emissions has your organization achieved in the last fiscal year?

<i>Decrease in pollution emissions</i>	<i># of answers</i>	<i>%</i>
None	0	0%
< 10%	31	31%
11-25%	38	38%
26-50%	7	7%
51-100%	7	7%
Not Applicable	9	9%
No answer	4	4%

Pittsburgh Survey Results

Q. 2. How important is pollution to your overall corporate performance?
(1= not important; 4= very important)

<i>Importance</i>	<i># of answers</i>	<i>%</i>
Not Important	1	3.33%
Somewhat Important	10	33.3%
Important	11	36.6%
Very important	10	33.3%
No Answer	0	0%

Q. 3. Factors affecting the company's environmental strategy
(1= not important; 4= very important)

<i>Factors</i>	<i>Importance (average)</i>
Improving technologies	2.8
Increasing market for "green" products	1.7
Regulations	3.3
Pressures from environmental groups	1.8
Corporate citizenship	2.7
Competition from competitors	2.0
Serving key customers	2.6
Increased productivity	2.7

Q. 4. What are the main element(s) of your pollution prevention strategy?

<i>Elements</i>	<i># of answers</i>	<i>%</i>
Facility downswing	2	6.6%
Treatment	8	26.6%
Source reduction	28	93.3%
Recycling	28	93.3%
Production process improvement	21	70.0%
End of pipe control technology	2	6.6%
Other	1	3.3%

Q. 5. What specific production process improvement(s) have played a significant role in your pollution prevention strategy?

<i>Production process improvements</i>	<i># of answers</i>	<i>%</i>
Conversion to substitute fuels	3	10.0%
Recycling	26	86.67%
Introduction of new product tech	14	46.6%
Conversion to closed or partially closed loop systems	9	30%
Upgrade of existing process tech	19	63.3%
Introduction of new process tech	14	46.67%
Other	1	3.3%

Q. 6. Is your organization pursuing reduced or zero emission standards?

<i>Emission Standards</i>	# of answers	%
Reduced	16	53.3%
Zero	1	3.33%
Not applicable	13	43.3%

Q. 7. Which of the following actor(s) play a key role in your pollution prevention strategy?

<i>Actors in pollution prevention</i>	# of answers	%
Top management	28	93.3%
R&D staff	13	43.3%
Engineers	18	60.0%
Line Workers	20	66.6%
Suppliers	13	43.33%
Distributors	3	10.0%
Consultants	6	20.0%
Environmental organizations	5	16.6%
Customers	12	40.0%
Other	1	3.3%

Q. 8. Does your organization have a Total Quality Environmental Management program in place?

<i>TQEM</i>	# of answers	%
Yes	7	23.3%
Not applicable	7	23.3%

Q. 9. What percentage of capital expenditures was devoted to pollution prevention in the past fiscal year?

<i>Capital expenditures</i>	# of answers	%
0%	4	13.3%
1-10%	15	50%
11-25%	4	13.3%
26-50%	0	0%
51-100%	0	0%
Not applicable	9	9.0%
No answer	0	0%

Q. 10. What % decrease in pollution emissions have you achieved in the last fiscal year?

<i>Decrease in pollution emissions</i>	# of answers	%
None	3	10.0%
< 10%	13	43.3%
11-25%	5	16.6%
26-50%	1	3.3%
51-100%	1	3.3%
Not Applicable	8	26.6%
No answer	1	3.3%

Appendix D: Pittsburgh's Manufacturing Base

As evidenced in the 1992 County Business patterns, Primary metal (3300) still makes up a sizable portion of the 5 county manufacturing economy. Primary metals accounted for almost 19% of employment, but only 5% of total firms. Fabricated Metal (3400) industries are almost 15% of the total base. Related industries of Machinery and Equipment (3500) make up almost 13% of the employee base, but nearly 19% of the establishments.

Other manufacturing industries in the region currently do not have the level of concentration which is seen in the overall metals sector, as described above. The other industries which comprise at least 5% of the employee base include Electronics (3600) with 5.62% of the region's manufacturing employees in 4.58% of the region's firms.

Another industry of some size is

the Stone (3200) industry, comprising 6.7% of both the employee and the establishment base of the overall region. Together, Chemicals (2800) and Plastics (3000) account for approximately 7.3% of the employee base. The Food industry is the only other industry with a concentration in the area, with 5.3% of all manufacturing employees as well as of establishments. In sum, the County Business Patterns data indicate that the region still has substantial employment in the Metalworking industries long characteristic of the economy of the area. However, a complete picture of the manufacturing economy must take into account a number of smaller industries which also employ a fair number of employees in the area.

Some information about the environmental performance characteristic of the above industries can be obtained from using national PACE data. The fabricated metals industry, which accounted for approximately 10 percent of 1992 manufacturing employment in the Pittsburgh region, is an industry that invested 4% of total capital expenditures in pollution prevention nationally in 1991. This was below the average of 8% for the US manufacturing sector as a whole. However, nationally fabricated metals spent 16 percent more on production process enhancements which reduce waste than on end-of-line pollution control technology. Another industry which is a big employer in Pittsburgh is primary metals, accounting for about 19 percent of 1992 manufacturing employment. Nationally, this industry invests a much higher percentage of its capital expenditures on pollution prevention, about 11% in 1991. Unfortunately, these investments tend to be disproportionately made on end-of-line control technology. In fact, production process enhancements in this industry were only 27 percent that of end-of-line expenditures in 1993.

Pittsburgh's 1992 Manufacturing Base (Allegheny, Beaver, Fayette, Washington, Westmoreland Counties)					
SIC Code	Industry	Total March Employees	Mid- Total Establishments	% of Total Manufacturing	
				Employees	Establishments
2000	Food	5845	135	5.28%	5.37%
2200	Textile	281	14	0.25%	0.56%
2300	Apparel	1836.5	76	1.66%	3.03%
2400	Lumber	2037	160	1.84%	6.37%
2500	Furniture	1066.5	65	0.96%	2.59%
2600	Paper	2448.5	34	2.21%	1.35%
2700	Printing	2613	124	2.36%	4.94%
2800	Chemicals	5279	105	4.77%	4.18%
2900	Petroleum	383.5	22	0.35%	0.88%
3000	Rubber	2920	103	2.64%	4.10%
3100	Leather	33	2	0.03%	0.08%
3200	Stone	7431	169	6.71%	6.73%
3300	Primary metal	20936	137	18.91%	5.45%
3400	Fabricated Metals	11024	365	9.96%	14.53%
3500	Machinery /Equipment	13909	476	12.57%	18.95%
3600	Electronic	6220	115	5.62%	4.58%
3700	Transportation equip	2094	43	1.89%	1.71%
3800	Instruments a	5399.5	103	4.88%	4.10%
3900	Miscellaneous	1129	126	1.02%	5.02%
399\	Administrative	17807.5	138	16.09%	5.49%
		110693	2512	100.00%	100.00%

Source: County Business Patterns 1992

Appendix E: Economic and Environmental Indicators

Goal

Identify trends in environmental and industrial performance in the Pittsburgh metropolitan area versus the top 25 metropolitan statistical areas (MSAs) in the United States, in addition to 3 relevant regions to our study.

Objectives

- Establish key questions to be addressed through an analysis of indicators
- Define environmental and economic indicators
- Hypothesize and diagram relationships between indicators
- Collect data on the indicators and rank MSAs accordingly
- Design a composite index based on rankings

Key Questions

1. Do metropolitan areas with a high new capital expenditure per manufacturing job rank better environmentally?
2. How does productivity correlate with environmental ranking?
3. Does high output equate with poor environmental performance in relation to other metropolitan areas?

Indicators Methodology

Economic

The indicators represent measures of metropolitan area economic performance and firm capital investment and productivity. Specifically we will focus on the industrial sector of the economy. The indicators we have chosen include:

- Productivity as measured by value added per worker
- Output as measured by value of shipments
- Investment as measured by capital expenditures

1987 Census of Manufactures - Geographic Area Series: The data for the economic variables were collected from the 1987 US Census of Manufacturers. The Bureau of the Census conducts the Census of Manufacturers every five years. The data are released on a national level, by SIC code, and in a Geographic Area Series. We had hoped to use information more recent than 1987, however the U.S. Census has not yet released the Geographic Area Series for the 1992 Census. 1992 data is scheduled to be available in the fall of 1995. The Census of Manufactures provided information about productivity (value added), investment (capital expenditures) and output (value of shipments) in the manufacturing sector of the economy. This report aggregates economic information by county and then by MSA.

Environmental

The indicators represent measures of environmental performance among industry. We are trying to see if how industry contributes to environmental problems or improvements. The indicators we have chosen are based on data reported to the US EPA as required by Public Law. BRS and TRI data are the best publicly available data at this time for tracking facility pollution. By using the Biennial Reporting System (BRS)

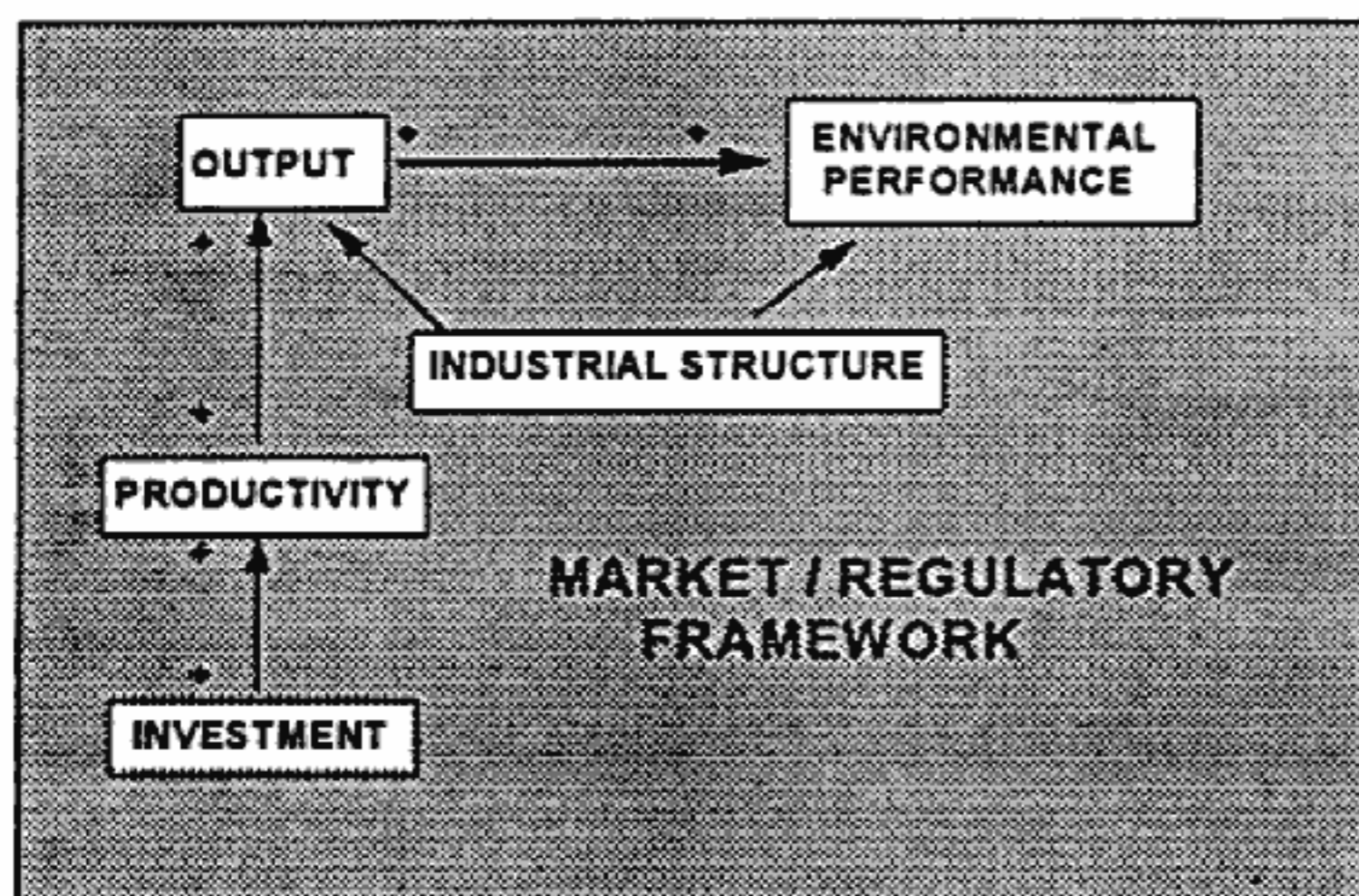
and the Toxic Release Inventory (TRI) we have provided a good balance of environmental data. The BRS data covers tons of hazardous waste generated and TRI covers the total pounds of toxic releases to air.

Sum of Air Releases (SAIR): Toxic Release Inventory (TRI) data is chemical specific, multimedia (although it main focuses on air releases), and facility-wide. Under the Emergency Planning and Community Right-To-Know Act of 1986 specific toxic chemicals released to the environment are required to be reported by releasing facility. However, it is not considered to be a complete measure of releases to the environment. Some of the limitations of this data are the limited number of chemicals listed for report, limited number of industries are required to report (SICs 20-39), and TRI only requires the reporting of estimated data and does not mandate that facilities monitor to get exact releases. This report aggregates pounds of all air releases (SAIR) in 1991 by county and then by MSA.

Hazardous Waste Generated : The BRS data is waste stream specific and facility wide and is required to be reported every two years under the Resource Conservation and Recovery Act (RCRA) of 1976, 42 U.S.C. 6901. The Law requires large quantity generators to report the total tons of hazardous waste they generate from various processes. Waste is classified as hazardous waste because of either the materials in it or the process which produces the waste. The data was obtained from the RTKNet, a public access source of environmental data run by OMB Watch and the Unison Institute. This report aggregates tons of hazardous waste generated in 1991 by county and then by MSA.

Relationships

The economic and environmental indicators are hypothesized to have a link between one another and can be organized into a larger influence diagram (see diagram below):



Data Collection, Rankings, and Composite Index

The following tables display the rankings among the 28 Metropolitan Statistical Areas used in this study. Each of these MSAs were ranked on investment, output, productivity, TRI, and BRS data. These rankings were then placed in a composite index table to get a sense for where each MSA stood. Finally, the rankings were averaged for each MSA and then plotted on a two-dimensional graph using economic and environment factors as the axis. For a fuller explanation of the data, MSA rankings, and Composite Index please see Section 4 of this paper. The following tables display the results of our research.

Metropolitan Statistical Area Definitions
(counties comprising the MSAs as defined by Woods and Poole Economics, Inc.)

ATLANTA		BOSTON		CLEVELAND	
Barrow	GA	Bristol	MA	Ashtabula	OH
Bartow	GA	Essex	MA	Cuyahoga	OH
Carroll	GA	Middlesex	MA	Geauga	OH
Cherokee	GA	Norfolk	MA	Lake	OH
Clayton	GA	Plymouth	MA	Lorain	OH
Cobb	GA	Suffolk	MA	Medina	OH
Coweta	GA	Worcester	MA		
DeKalb	GA	Hillsborough	NH		
Douglas	GA	Rockingham	NH	DALLAS	
Fayette	GA	Strafford	NH	Collin	TX
Forsyth	GA			Dallas	TX
Fulton	GA	CHATTANOOGA		Denton	TX
Gwinnett	GA	Catoosa	GA	Ellis	TX
Henry	GA	Dade	GA	Henderson	TX
Newton	GA	Walker	GA	Hunt	TX
Paulding	GA	Hamilton	TN	Kaufman	TX
Pickens	GA	Marion	TN	Rockwell	TX
Rockdale	GA				
Spalding	GA	CHICAGO		DENVER	
Walton	GA	Cook	IL	Adams	CO
		DeKalb	IL	Arapahoe	CO
AUSTIN		DuPage	IL	Denver	CO
Bastrop	TX	Grundy	IL	Douglas	CO
Caldwell	TX	Kane	IL	Jefferson	CO
Hays	TX	Kendall	IL		
Travis	TX	Lake	IL		
Williamson	TX	McHenry	IL		
		Will	IL	DETROIT	
				Lapeer	MI
BALTIMORE		CINCINNATI		Macomb	MI
Anne Arundel	MD	Dearborn	IN	Monroe	MI
Baltimore	MD	Ohio	IN	Oakland	MI
Carroll	MD	Boone	KY	St. Clair	MI
Harford	MD	Campbell	KY	Wayne	MI
Howard	MD	Gallatin	KY		
Queen Annes	MD	Grant	KY	HOUSTON	
Baltimore City	MD	Kenton	KY	Chambers	TX
		Pendleton	KY	Fort Bend	TX
		Brown	OH	Harris	TX
		Clermont	OH	Liberty	TX
		Hamilton	OH	Montgomery	TX
		Warren	OH	Waller	TX

Metropolitan Statistical Area Definitions (Cont'd)
(counties comprising the MSAs as defined by Woods and Poole Economics, Inc.)

KANSAS CITY		NEW YORK CITY (CONT'D)		SEATTLE	
Johnson	KS	Queens	NY	Island	WA
Leavenworth	KS	Richmond	NY	King	WA
Miami	KS	Rockland	NY	Snohomish	WA
Wyandotte	KS	Westchester	NY		
Cass	MO			ST. LOUIS	
Clay	MO	PHILADELPHIA		Clinton	IL
Clinton	MO	Burlington	NJ	Jersey	IL
Jackson	MO	Camden	NJ	Madison	IL
Lafayette	MO	Gloucester	NJ	Monroe	IL
Platte	MO	Salem	NJ	St. Clair	IL
Ray	MO	Bucks	PA	Franklin	MO
		Chester	PA	Jefferson	MO
LOS ANGELES		Delaware	PA	Lincoln	MO
Los Angeles	CA	Montgomery	PA	St. Charles	MO
		Philadelphia	PA	St. Louis	MO
MIAMI				Warren	MO
Dade	FL	PHOENIX		St. Louis (City)	MO
		Maricopa	AZ		
MILWAUKEE		Pinal	AZ	TAMPA	
Milwaukee	WI			Hernando	FL
Ozaukee	WI	PITTSBURGH		Hillsborough	FL
Washington	WI	Allegheny	PA	Pasco	FL
Waukesha	WI	Beaver	PA	Pinellas	FL
		Butler	PA		
MINNEAPOLIS-ST PAUL		Fayette	PA	WASHINGTON, DC	
Anoka	MN	Washington	PA	District of Columbi	DC
Craver	MN	Westmoreland	PA	Calvert	MD
Chisago	MN			Charles	MD
Dakota	MN	PORTLAND		Frederick	MD
Hennepin	MN	Clackamas	OR	Montgomery	MD
Isanti	MN	Columbia	OR	Prince Georges	MD
Ramsey	MN	Multnomah	OR	Arlington	VA
Scott	MN	Washington	OR	Clarke	VA
Sherburne	MN	Yamhill	OR	Culpeper	VA
Washington	MN	Clark	WA	Fauquier	VA
Wright	MN			King George	VA
Pierce	WI	SAN DIEGO		Loudon	VA
St. Croix	WI	San Diego	CA	Stafford	VA
				Fairfax	VA
NEW YORK CITY		SAN FRANCISCO		Prince William	VA
Bronx	NY	Marin	CA	Spotsylvania	VA
Kings	NY	San Francisco	CA	Berkeley	WV
New York	NY	San Mateo	CA	Jefferson	WV
Putnam	NY				

1991 BIENNIAL REPORTING SYSTEM DATA

Tons of Hazardous Waste Generated per SMillion of Shipments

RANK	MSA	TONS PER SMILLION IN SHIPMENTS	HAZARDOUS WASTE (TONS)
1	MILWAUKEE	-	-
2	CHICAGO	0.5	40143
3	CHATTANOOGA	0.5	2834
4	CINCINNATI	1.8	40923
5	ST. LOUIS	3.3	121727
6	CLEVELAND	5.2	170612
7	LOS ANGELES	10.3	1026050
8	ATLANTA	10.6	328566
9	MIAMI	14.1	94787
10	TAMPA	15.8	135224
11	SAN FRANCISCO	20.1	181890
12	WASHINGTON DC	21.0	219349
13	NEW YORK CITY	22.6	1225348
14	KANSAS CITY	23.7	451106
15	PORTLAND	31.2	429025
16	DENVER	40.7	493277
17	DETROIT	42.4	3155115
18	SEATTLE	57.8	1350652
19	BOSTON	74.9	4726020
20	PHOENIX	119.9	1808139
21	SAN DIEGO	132.9	1460900
22	MINNEAPOLIS-ST. PAUL	182.4	5584896
23	BALTIMORE	224.5	4313552
24	DALLAS	260.0	6235559
25	PITTSBURGH	447.4	7001159
26	PHILADELPHIA	748.2	38341395
27	AUSTIN	1005.3	5463738
28	HOUSTON	1489.7	55665177

Source: U.S. Environmental Protection Agency, Office of Solid Waste. Biennial Reporting System, 1991 as appearing on RTKNet.

1991 TOXICS RELEASE INVENTORY DATA

TRI Pounds per SMillion in Shipments - Air Releases

RANK	MSA	TRI - AIR RELEASES (POUNDS)	AIR RELEASES PER SMILLION IN SHIPMENTS
1	SAN FRANCISCO	450393	50
2	NYC	3017300	56
3	AUSTIN	955350	176
4	WASHINGTON, DC	2158565	206
5	LOS ANGELES	25512687	255
6	BOSTON	16618495	264
7	ATLANTA	9136601	296
8	SAN DIEGO	3561487	324
9	DETROIT	24388188	328
10	MIAMI	2247435	334
11	DALLAS	8159270	340
12	BALTIMORE	6945661	361
13	CINCINNATI	8312907	364
14	PHILADELPHIA	19714612	385
15	PHOENIX	5823400	386
16	MILWAUKEE	8035094	421
17	SEATTLE	9864854	422
18	CHICAGO	38697668	452
19	ST. LOUIS	16487816	453
20	KANSAS CITY	8708717	457
21	CLEVELAND	15630360	476
22	MN-ST. PAUL	15393275	503
23	PORTLAND	7067814	514
24	TAMPA	4920535	576
25	PITTSBURGH	9010473	576
26	CHATTANOOGA	5856769	1022
27	HOUSTON	45918861	1228
28	DENVER	24388188	2012

Source: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics.
1991 Toxics Release Inventory.

PRODUCTIVITY
Value Added per Manufacturing Worker

RANK	MSA	VALUE ADDED BY MANUFACTURE (\$ millions)	NUMBER OF PRODUCTION WORKERS (thousands)	VALUE ADDED PER WORKER
1	HOUSTON	14,053.50	83.70	167.90
2	CINCINNATI	11,488.40	83.90	136.93
3	AUSTIN	2,948.60	21.60	136.51
4	KANSAS CITY	8,930.50	66.70	133.89
5	WASHINGTON, DC	6,153.60	48.30	127.40
6	MINNEAPOLIS	15,850.10	129.60	122.30
7	SAN FRANCISCO	5,374.60	45.10	119.17
8	DENVER	6,587.20	56.10	117.42
9	ST. LOUIS	14,179.80	126.20	112.36
10	SEATTLE	9,820.10	87.60	112.10
11	BALTIMORE	9,675.50	86.60	111.73
12	ATLANTA	14,672.20	134.00	109.49
13	BOSTON	37,251.40	341.70	109.02
14	CHICAGO	44,102.70	410.40	107.46
15	PHILADELPHIA	24,115.50	228.60	105.49
16	NEW YORK CITY	29,745.20	282.00	105.48
17	PHOENIX	8,502.10	80.80	105.22
18	DALLAS	13,173.90	125.30	105.14
19	DETROIT -	27,874.50	270.00	103.24
20	CLEVELAND	15,001.30	148.10	101.29
21	SAN DIEGO	6,426.80	67.40	95.35
22	PORTLAND	6,694.80	71.50	93.63
23	MILWAUKEE	9,666.20	104.90	92.15
24	LOS ANGELES	50,905.60	557.20	91.36
25	PITTSBURGH	6,949.90	82.40	84.34
26	TAMPA	4,139.70	51.20	80.85
27	CHATTANOOGA	2,295.20	32.20	71.28
28	MIAMI	3,561.90	62.20	57.27

SOURCE: 1987 CENSUS OF MANUFACTURERS

INVESTMENT

New Capital Expenditures per \$ of Shipment in 1987

RANK	MSA	NEW CAPITAL EXPENDITURES (S in millions)	VALUE OF SHIPMENTS (S millions)	NEW CAPITAL EXPENDITURES PER \$ OF SHIPMENT
1	AUSTIN	283.20	5,435.10	0.052
2	PHOENIX	663.00	15,084.30	0.044
3	SAN DIEGO	429.00	10,996.60	0.039
4	DENVER	441.70	12,121.80	0.036
5	DALLAS	858.00	23,983.20	0.036
6	KANSAS CITY	668.80	19,055.30	0.035
7	BOSTON	2,138.50	63,057.70	0.034
8	TAMPA	279.20	8,546.90	0.033
9	PORTLAND	445.20	13,747.20	0.032
10	MINNEAPOLIS	970.60	30,611.40	0.032
11	WASHINGTON, DC	323.70	10,454.70	0.031
12	CLEVELAND	992.50	32,834.40	0.030
13	LOS ANGELES	2,995.50	99,888.60	0.030
14	CHATTANOOGA	171.50	5,731.70	0.030
15	CINCINNATI	674.50	22,837.70	0.030
16	ATLANTA	881.40	30,917.80	0.029
17	HOUSTON	1,060.50	37,367.60	0.028
18	MILWAUKEE	541.80	19,104.30	0.028
19	DETROIT	1,946.40	74,393.40	0.026
20	CHICAGO	2,194.80	85,583.0	0.026
21	BALTIMORE	492.70	19,215.20	0.026
22	PITTSBURGH	400.30	15,647.80	0.026
23	PHILADELPHIA	1,290.60	51,245.0	0.025
24	SAN FRANCISCO	224.50	9,053.0	0.025
25	ST. LOUIS	875.20	36,364.70	0.024
26	SEATTLE	549.30	23,363.70	0.024
27	NEW YORK CITY	1,101.60	54,137.90	0.020
28	MIAMI	132.00	6,734.40	0.020

SOURCE: 1987 Census Of Manufacturers

OUTPUT

Millions of Dollars of Shipments in 1987

RANK	MSA	VALUE OF SHIPMENTS (\$ millions)
1	LOS ANGELES	99,888.60
2	CHICAGO	85,583.00
3	DETROIT -	74,393.40
4	BOSTON	63,057.70
5	NEW YORK CITY	54,137.90
6	PHILADELPHIA	51,245.00
7	HOUSTON	37,367.60
8	ST. LOUIS	36,364.70
9	CLEVELAND	32,834.40
10	ATLANTA	30,917.80
11	MINNEAPOLIS	30,611.40
12	DALLAS	23,983.20
13	SEATTLE	23,363.70
14	CINCINNATI	22,837.70
15	BALTIMORE	19,215.20
16	MILWAUKEE	19,104.30
17	KANSAS CITY	19,055.30
18	PITTSBURGH	15,647.80
19	PHOENIX	15,084.30
20	PORTLAND	13,747.20
21	DENVER	12,121.80
22	SAN DIEGO	10,996.60
23	WASHINGTON, DC	10,454.70
24	SAN FRANCISCO	9,053.00
25	TAMPA	8,546.90
26	MIAMI	6,734.40
27	CHATTANOOGA	5,731.70
28	AUSTIN	5,435.10

SOURCE: 1987 Census Of Manufacturers

