Do Green Businesses Benefit Communities?

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Richard Florida
H. John Heinz III Professor of Regional Development
H. John Heinz III School of Public Policy and Management
Carnegie Mellon University
Pittsburgh, PA 15213
Email: florida@andrew.cmu.edu

Derek Davison
H. John Heinz III School of Public Policy and Management
Carnegie Mellon University
Pittsburgh, PA 15213
Email: jazz+@cmu.edu

Matthew Cline
Chemical Engineering Department
Carnegie Mellon University
Pittsburgh, PA 15213
Email: mc86@andrew.cmu.edu

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ABSTRACT

This paper examines whether green businesses extend the basic lessons and benefits of advanced environmental management systems to communities. We advance the basic hypothesis that there is considerable spillover benefit between environmental practices that lead to performance gains inside the organization and those that confer benefits to the external community. Our underlying theory is that organizations that have realized improvements in their own, internal industrial and environmental performance are likely to seek to extend these advanced practices across the factory gates to include their relationships with and impacts upon local communities. To test this hypothesis, a survey of manufacturing establishments was conducted.

The findings of the research confirm the hypothesis. There appears to be considerable overlap in the practices that are the source of both environmental performance improvement inside the plant and of reduced environmental risks to communities. The findings indicate that companies with advanced environmental practices are significantly more likely to share information with community groups and obtain input from community and environmental groups in their environmental decision-making and priority setting. Advanced plants also pose less environmental risk and generate more significant community environmental benefits than plants without such programs.

Key words: environmental management systems, pollution prevention, community environmental impacts

INTRODUCTION

Since the dawn of the industrial age, the goals of economic growth and enhanced environmental quality have been at odds. The rise of industries such as steel, chemicals, automobiles, and electricity brought increased wealth, productivity, and profit, but also carried adverse environmental outcomes. This stark tradeoff between economy and environment was particularly evident in industrial regions, which grew and prospered around resource extraction and heavy manufacturing. In such places, the environment was often seen as something that could be sacrificed in the pursuit of economic growth. Growing out of this stark tradeoff, the latter part of the century saw the rise of aggressive environmental policies and regulations that addressed the relationship by imposing strict limits on the waste and emissions produced by manufacturing companies (Andrews 1999). These approaches certainly produced important gains, but as leading commentators around the world have noted, this command-and-control approach to environmental policy may have reached the point of diminishing returns (Strasser 1996).

In recent years, however, leading corporations have pioneered new strategies for integrating the environment into their overall business strategy and for simultaneously improving their environmental and business performance (Porter 1991; Schmidheiny 1992; Schot 1992; Porter and van der Linde 1995a, 1995b; Hart and Ahujba 1994). They are, to turn a phrase, becoming "leaner and greener" at the same time (Florida 1995; Florida, Atlas, and Cline 1999). These companies are motivated not by altruistic concerns, but by the bottom-line drive to increase profits, productivity, and performance by reducing waste and emissions. Around the world, a new three zero manufacturing paradigm is emerging, where companies simultaneously work to achieve zero defects (quality), zero inventory (just in time inventory and supplier relations), and zero waste and emissions. While attention is being paid to these corporate efforts to integrate the

environment into business strategy, the potential community impacts of these strategies have been overlooked.

This paper explores the hypothesis that business establishments that have adopted advanced environmental practices extend the basic lessons and efficiencies associated to the communities in which they are located. In simple terms, we hypothesize that there is considerable spillover benefit between environmental practices that confer benefits inside the organization and those that benefit the external community. Our underlying theory is that organizations that have realized improvements in their own, internal industrial and environmental performance are likely to seek to extend advanced environmental practices across the factory gates to include their relationships with and impacts upon local communities. Building upon their advanced practices and organizational capabilities, these organizations seek to involve communities in environmental decision-making and priority seeking and to minimize waste and emission streams that may pose risks to those communities

To further probe this hypothesis, the paper examines three key questions. First, is the adoption of advanced environmental practices associated with the adoption of more innovative management practices in general? Second, do business organizations that have adopted innovative environmental and management practices extend the basic lessons and principles associated with those practices to their dealings with communities? In other words, do plants extend the basic principles of information sharing and employee involvement to include information sharing with communities and input from community and other stakeholder groups in the design and development of environmental programs? Third, to what degree do business organizations extend and leverage the environmental performance gains they have achieved inside the plant to reduce waste and emission streams and other factors which pose environmental risk to the communities in which they are located?

To shed light on these questions, the research collected data from a survey of 583 manufacturing plants. The findings seem to confirm the hypothesis. We find that business organizations that have internally adopted advanced environmental practices tend to learn from and extend the benefits of those practices to their dealings with communities. The findings indicate that plants with advanced environmental practices are significantly more likely to share information with community and environmental groups and obtain input from those groups in their environmental decision-making process. These practices reflect an underlying commitment to the core principles of advanced management (e.g. information sharing and involvement of all stakeholders in decision-making). Our survey findings also suggest that business organizations with advanced environmental practices pose less environmental risk and generate more positive community environmental impacts than those that do not use such practices.

The remainder of this paper is organized as follows. The next section summarizes the project design and research methodology. The third section summarizes the key findings of the survey, focusing on community relations and impacts. The final section summarizes our key findings.

RESEARCH DESIGN

The research is principally based upon a survey of manufacturing establishments. The survey collected information on: (1) plant characteristics (e.g. plant size, industry, and employment), (2) adoption of advanced environmental and management practices (e.g. environmental management systems, pollution prevention, quality management, ISO 14000, etc.), (3) community environmental activities, modes of information sharing, and mechanisms for obtaining community input on environmental priority-setting and information sharing, and (4) community environmental impacts (e.g. waste and emission streams, noise, odor, and employment). The survey was administered between September 1998 and February 1999. The survey instrument was pre-tested with a small sample of manufacturing plants. Experts in survey

design and community environmental impacts from academia, the consulting community, industry, environmental groups, and government agencies also reviewed the survey instrument.

Survey Sample: The survey was administered to a total of 583 manufacturing plants in the state of Pennsylvania. The sample was designed to compare the environmental performance of advanced environmental plants to that of non-advanced plants. To accomplish this, the overall sample was composed of three sub-samples. The first sub-sample (N=242) was a stratified random sample of all manufacturing plants in Pennsylvania. This group was stratified by industry and size and selected from the *1998 Harris Directory* of manufacturing plants in Pennsylvania. Two additional sub-samples were used to ensure that the sample included a significant number of plants that had adopted advanced environmental practices. A second sub-sample (N=66) was drawn from manufacturing plants that were recipients of the Pennsylvania Governor's Award for Environmental Excellence for the years 1996 and 1997. The third sub-sample (N=275) represents plants that have shown some interest in advanced environmental practices and was drawn from lists of manufacturing firms that participated in regional Pollution Prevention Roundtables.

Survey Administration: The survey was administered by facsimile and included follow up facsimiles and telephone calls to maximize response rate. Approximately two weeks after the initial fax, a second fax was sent to those companies that had not yet responded. After another two to three weeks, follow-up phone calls were made to plants that had not yet responded. At that point, plants were given the option of being removed from the initial survey and being classified as non-respondents.

Of the 583 sample plants, 158 indicated that they were unwilling to participate in the survey. Of the remaining 425 plants, 214 responded to the survey for an adjusted response rate of 50.4 percent. Additionally, a wide range of manufacturing industries was represented in the

sample. The top three industries represented were chemicals and allied products (12.6 percent), primary metals (10.3 percent), and fabricated metals (10.3 percent). Electrical and electronic machinery (7 percent); rubber and plastic products (7 percent); paper and allied products (6.5 percent); electric, gas, and sanitary services (6.5 percent), and non-electrical machinery (6.1 percent) all comprised more than five percent of the sample. Fourteen industries composed 1 percent or more of survey respondents. It is important to keep in mind that the findings mainly reflect the perceptions of manufacturing plants on the nature of their community environmental performance. While the field research did include interviews with community representatives, the survey research was based upon manufacturing plants only. The research findings should be interpreted with this in mind.

Field Research: The field research was used to supplement and extend the findings of the survey research. Because of limits of time and resources, it was impossible to develop a large number of field research sites across the entire distribution of plants or to utilize control groups or matched pairs of plants. Field research sites were selected from survey respondents who had adopted advanced environmental practices (e.g. EMS and P2 programs). Sites were also selected to account for different sizes of plants in different types of communities.

Company reports and government documents were reviewed for plant background. Preliminary phone interviews were conducted with plant management and environmental representatives, to obtain information on environmental initiatives and community impacts and to insure that the plants were viable field research candidates. Site visits, including a plant tour, of approximately ½ day were conducted at each facility. A team of two social scientists and an engineer with expertise in plant production and environmental and waste emissions control technologies conducted these site visits. Interview questions were developed for each facility based on a review of reports, documents, and their completed survey form, and covered plant practices, corporate practices, environmental performance, community relations, community

impacts, and the factors associated with these initiatives. Interviews were conducted with plant management and environmental staff to obtain information on plant characteristics and environmental performance. Interviews were also conducted with community officials, community residents, government agency personnel, and local government leaders to obtain additional information on the community impacts of plant practices. More than two dozen interviews were conducted at the five sites.

FINDINGS

We now turn to the findings of the research. We begin by reporting the findings with regard to the adoption of advanced practices. We then turn to discuss the findings with regard to community relationships, followed by a discussion of community environmental impacts.

Adoption of Advanced Environmental Practices

Around the country and the world, leading companies are moving to adopt advanced environmental practices that bolster both environmental performance and competitiveness. Environmental management systems (EMS) are increasingly recognized as the most systematic and comprehensive mechanism for improving environmental and business performance. The survey collected detailed information on the kinds of practices plants are using and the reasons why they are adopting them.

EMS and P2 Adoption: Tables 1 presents the rates of EMS and P2 adoption and other key characteristics of sample plants. Almost 30 percent (29.0 percent) of plants in the entire sample can be classified as **"high-adopters**" – that is, they had adopted **both** an EMS and a P2 program. Additionally, more than 40 percent of plants in the entire sample had either a formalized EMS (42.1 percent) or an active P2 program (40.7 percent). More that 45 percent (46.3 percent) of plants in the entire sample can be classified as **"non-adopters"** – meaning that they did not use either an EMS or a P2 program.

Table 1: Key Characteristics of Sample Plants

Characteristic	Total (N=214)	High-adopters (N=62)	Non-adopters (N=99)
Environmental Management Systems (EMS)	42.1%	-	-
Pollution Prevention (P2)	40.7%	-	-
EMS & P2	29.0%	-	-
Number of Employees	912.4	910.7	677.2
EHS Staff ***	6.0	8.1	2.0
Environmental Staff **	4.2	4.5	1.4
Independently Owned ***	43.0%	27.4%	58.6%
Part of Multi-Plant Company ***	47.7%	72.6%	31.3%

Significance:
*** significant at the .01 level
** significant at the .05 level
* significant at the .1 level

Source: Florida, et al., *Community Environmental Impacts Survey* (1999)

There are significant differences between high-adopter and non-adopter plants in terms of size and dedicated environmental resources (see Table 1). High-adopters are on average almost 250 employees larger than non-adopters (910.7 employees versus 677.2). Additionally, high-adopters have over four times the Environmental, Health and Safety staff than non-adopters (8.1 versus 2.0) and over three times the dedicated environmental staff (4.5 versus 1.4). Moreover, high-adopters tend to be corporate-owned (72.6 percent compared with 27.4 percent independently owned), while non-adopters are more often independently owned (58.6 percent compared to 31.3 percent corporate-owned). These findings suggest that high-adopters have a greater pool of internal and corporate-level resources to devote environmental performance improvement. This is in line with the findings of previous research, which indicates that resources are an important and determinant factor in both the adoption and effectiveness of advanced environmental management (see Florida 1995; Florida, Atlas, and Cline 1999).

The field research findings reinforce this point. Of the five field research sites, three were larger plants (with more than 500 employees). Of these three, two were divisions of large corporations (as was one of the two smaller plants), which could and did provide additional

resources to address environmental issues. Site visits and interviews indicate that these resources were important enabling factors in the adoption of advanced environmental practices.

Motivating Factors in EMS and P2 Adoption: The survey asked plants to identify the factors that motivated them to adopt EMS and/or P2 programs. These factors included regulatory measures, economic benefits, internal commitment to environmental improvement, and community relations (see Table 2).

The findings indicate that high-adopters were four to five times more likely than non-adopters to report each of these factors as a motivating factor. The differences between the high-adopter and non-adopter groups were significant in each and every case. More than 90 percent (91.9 percent) of high-adopters reported "commitment to environmental improvement" as a motivating factor, followed by corporate goals and objectives (88.7 percent), business performance (87.1 percent), community relations (85.5 percent), state regulatory climate (85.5 percent), and federal regulatory climate (83.9 percent). Note the importance that high-adopters place upon community relations as a motivating factor. Community relations ranked fourth, just behind a cluster of three business-related factors and just six percentage points behind the top-ranked factor.

The survey also asked respondents to rank the relative importance of these factors on a scale of 1-6, with 1 being the most important factor. These ratings reinforce the findings reported above. High-adopters rated corporate goals (2.07), commitment to environmental improvement (2.54), state regulatory climate (3.13), business performance (3.46), federal regulatory climate (3.50), and improved community relations (4.38) as the top-ranked factors motivating them to adopt EMS and P2 programs. These responses indicate that a range of factors – e.g. regulations, business concerns, and community concerns – are motivators for the adoption of advanced practices.

Table 2: Factors Motivating EMS and P2 Adoption

Factors	Total (N=214)	High-adopters (N=62)	Non-adopters (N=99)
Commitment to environmental improvement ***	56.1%	91.9%	22.2%
Corporate goals/objectives ***	55.1%	88.7%	20.2%
State regulatory climate ***	54.2%	85.5%	23.2%
Federal regulatory climate ***	53.7%	83.9%	24.2%
Economic benefits/business performance ***	52.3%	87.1%	19.2%
Improved community relations ***	51.9%	85.5%	21.2%
Other	1.9%	3.2%	0.0%

Significance:
*** significant at the .01 level
** significant at the .05 level
* significant at the .1 level

Source: Florida, et al., *Community Environmental Impacts Survey* (1999)

Motivating Factors in Overall Environmental Improvement: In addition to factors specific to EMS/P2 adoption, the survey also asked respondents to report and rank the factors that motivated them to pursue overall environmental improvement. Table 3 reports these results.

More than 90 percent of high-adopters reported factors such as regulatory compliance (100 percent), cost savings (100 percent), improved business performance (96.8 percent), and self-motivation (93.5 percent) as important. Other widely reported factors included employee concerns (88.7 percent), customer relations (88.7 percent), and community concerns (87.1 percent). In every case, the difference between high-adopters and non-adopters was statistically significant, suggesting that high-adopters may be more responsive to (or at least more aware of) both internal and external pressures to improve environmental performance than non-adopters.

The survey also asked respondents to rank the factors that motivated them to improve their environmental performance. Respondents ranked each of these factors on a 1-N scale where 1 is most important (thus lower scores reflect more important factors). For high-adopters, the top rated factors were: regulatory compliance (1.63), cost savings (3.82), self-motivation (3.95), and improved business performance (4.68), followed by community concerns (5.37), employee

concerns (5.67), and customer relations (5.67). Interestingly, of these highly ranked factors, regulatory compliance was the only one to exhibit a statistically significant difference for high- and non-adopters. That is, high-adopters were significantly more likely to adopt advanced environmental practices to comply with environmental regulations.

Table 3: Factors Motivating Major Environmental Initiatives

Factors	Total (N=214)	High-adopters (N=62)	Non-adopters (N=99)
Regulatory compliance ***	94.4%	100.0%	89.9%
Cost savings ***	89.7%	100.0%	80.8%
Self-motivated **	86.0%	93.5%	81.8%
Improved business performance ***	83.2%	96.8%	73.7%
Community pressure/concerns **	79.0%	87.1%	73.7%
Employee pressure/concerns ***	78.5%	88.7%	70.7%
Improved customer relations ***	76.2%	88.7%	69.7%
Improved supplier relations **	72.0%	82.3%	67.7%
New product development *	71.5%	80.6%	68.7%
New technology development *	71.5%	80.6%	67.7%
Catalyzing incident *	70.6%	80.6%	67.7%
Other	2.8%	3.2%	3.0%

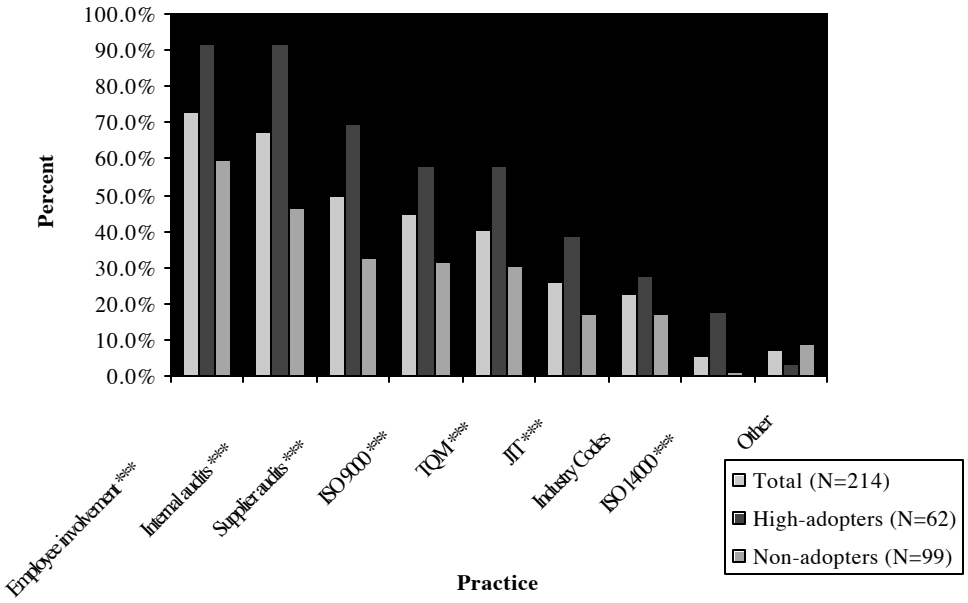
Significance:
*** significant at the .01 level
** significant at the .05 level
* significant at the .1 level

Source: Florida, et al., *Community Environmental Impacts Survey* (1999)

Adoption of Other Advanced Practices: Studies have suggested that advanced environmental practices reflect a corporate commitment to advanced management in general (see Florida 1995; Florida, Atlas, Cline 1999). Other studies indicate that advanced plants tend to adopt an interrelated bundle of advanced practices such as team-based work, employee input in decision-making, quality management and so on (see Ichinpowski, Shaw, and Prennushi 1993, MacDuffie 1994, Jenkins and Florida 1998, Florida and Jenkins 1999). To probe these issues, the survey looked at the adoption of a wide range of advanced management, such as ISO 9000 and 14000 certification, employee involvement in shop-floor decision-making, internal and external environmental audits, total quality management, just-in-time inventory control, and so on.

The survey findings, reported in Figure 1, indicate that high-adopters were significantly more likely to adopt a wide range of advanced or innovative practices. High-adopter plants were more than twice as likely to make use of internal and external audits, ISO 14000 certification, and just-in-time inventory control. More than 90 percent (91.9 percent) of high-adopter plants reported using internal environmental audits compared with 46.5 percent of non-adopters. Nearly twice as many (58.1 percent) high-adopters reported having a total quality management program compared as non-adopters (30.3 percent). High-adopters were also twice as likely as non-adopters to report using a just-in-time system for inventory control (38.7 versus 17.2 percent). Furthermore, high-adopters plants were far more likely to be ISO 14000 certified than non-adopters – with 17 percent of high-adopters reporting ISO 14000 certification compared to just 1 percent of non-adopters.

Figure 1: Adoption of Advanced Practices by Sample Plants

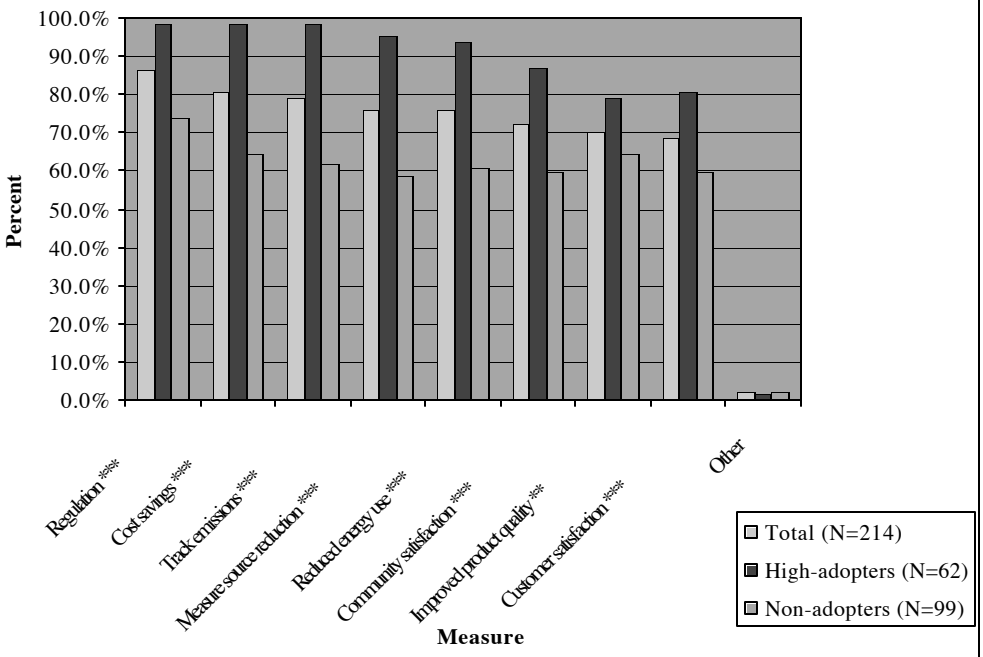


Source: Florida, et al, *Community Environmental Benefits Survey* , 1999

Environmental Performance Measures: Environmental performance measures are mechanisms by which companies can jointly improve their environmental and business performance. Previous research (Florida, Atlas and Cline 1999) found that environmental performance measurement systems are a key factor in effective implementation of environmentally conscious manufacturing systems. The survey obtained detailed information on the various methods that companies use to track environmental performance, ranging from the costs of compliance to tracking emissions and community satisfaction.

As Figure 2 shows, high-adopters were significantly more likely to report using performance measures to track and monitor the following: regulatory compliance, waste elimination, energy use, product quality, customer satisfaction, and community satisfaction. More than 90 percent of high-adopters reported using environmental performance measurements to track and monitor regulatory compliance, waste and emission reduction, and reduced energy use, compared to between 58 and 70 percent of non-adopters. Furthermore, 87 percent of high-adopters reported using performance measures to monitor and track community satisfaction, compared to 59 percent of non-adopters.

Figure 2: Environmental Performance Measures



Source: Florida, et al, *Community Environmental Benefits Survey* , 1999

The survey also asked respondents to rate these factors on a 1-to-4 scale with 4 being most important. High-adopters rated environmental performance measurement as most important in the areas of regulatory compliance (3.59) and cost savings from waste reduction (3.18). High-adopters were statistically significantly more likely than non-adopters to use environmental performance measurement system to track and monitor waste and emission reduction and to improve customer relations.

Summary Scores: The study developed a series of summary scores to look in an overall sense at the adoption of advanced environmental and overall management practices (see Table 4). High-adopters were much more likely to employ the entire bundle of advanced environmental and management practices. High-adopters scored nearly three times as high as non-adopters in the use of advanced management practices – scoring 59.38 versus 21.40. High-adopters were nearly twice as likely than non-adopters to make use of advanced management systems consisting of

both advanced management practices and performance measurement systems, scoring 64.85 versus 34.78. (Both results are statistically significant at the .01 level). The summary scores thus suggest that there is significant symmetry between the adoption of advanced environmental practices and the adoption of advanced management practices more generally. We find that high-adopter plants are likely to adopt a broad bundle of innovative practices including EMS, P2, total quality management, employee involvement, performance measurement systems, and other innovative practices. Adoption of EMS and P2 practices is thus associated with plants that are both larger and more innovative overall.

Table 4: Summary Scores for Sample Plants

Advanced Practices	High-adopters (N = 62)	Non-adopters (N = 99)
Assessment ***	70.31	48.17
Management ***	59.38	21.40
Overall ***	64.85	34.78
Community Relations	High-adopters (N = 62)	Non-adopters (N = 99)
Activities ***	23.55	7.27
Involvement ***	16.56	6.77
Information Sharing ***	37.48	18.60
Overall ***	32.65	17.31
Community Environmental Impact	High-adopters (N = 62)	Non-adopters (N = 99)
Direct Impact **	28.19	20.71
Indirect Impact **	32.54	24.04
Overall ***	30.36	22.37

Significance:
*** significant at the .01 level
** significant at the .05 level
* significant at the .1 level

Source: Florida, et al., *Community Environmental Impacts Survey* (1999)

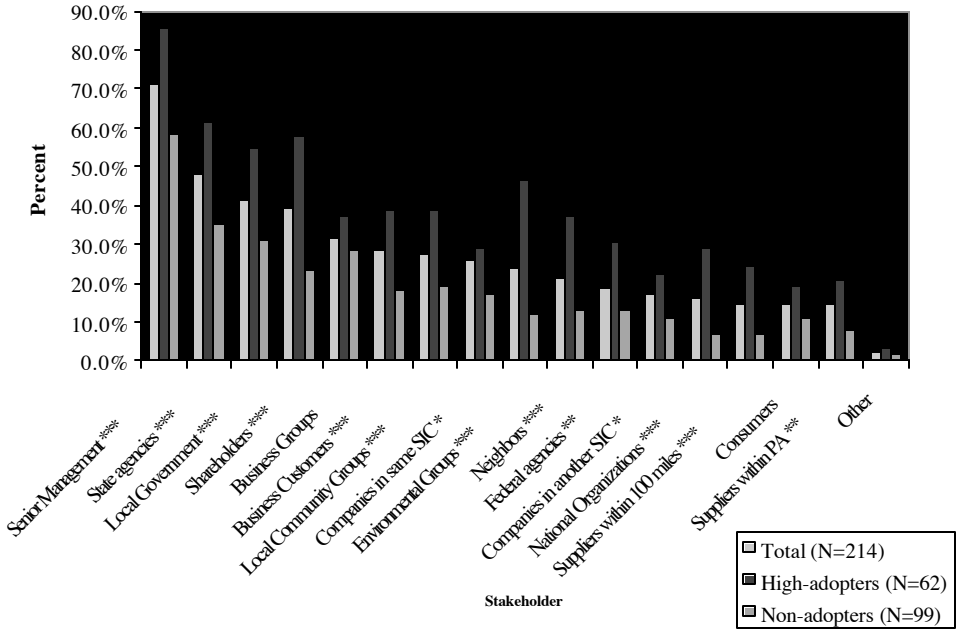
Company-Community Relationships

Studies have shown that advanced management systems are associated with interrelated systems of practices that foster information sharing, promote team work and cultivate employee input in decision-making (Shaw, Ichniowski, and Prennushi 1993; Jenkins and Florida 1998). We wanted to see to what degree advanced plants reflected these underlying practices in their dealings with communities. To what extent did plants with advanced environmental practices share information with communities' and/ or involve community groups in the design and development of relevant environmental initiatives?

Environmental Information Sharing: The survey obtained information on the degree to which plants share information on their environmental practices with various groups (e.g. government agencies, business, neighbors, community groups, environmental groups and so on).

Generally speaking, the findings indicate that high-adopters were more likely to report information sharing with virtually every group (see Figure 3). High-adopters were significantly more likely to report sharing information with government agencies, business customers, neighbors, and environmental groups. High-adopters were more than twice as likely to share information with local neighbors – 37.1 percent versus 13.1 percent; and they were almost four times more like to share information with environmental groups – 46.8 percent versus 12.1 percent.

Figure 3: Environmental Information Sharing by Sample Plants



Source: Florida, et al, *Community Environmental Benefits Survey* , 1999

Plants can share information about the results of their environmental through a variety of methods. The survey looked at several methods for such information sharing including press releases, plant tours, local school programs, private briefings, community meetings, and citizen advisory groups.

The findings indicate that high-adopters were nearly twice as likely to share results with the local community as non-adopters, 46.8 percent versus 24.2 percent. A newsletter was the most widely used form of information sharing. High-adopters were significantly more likely to share information via each mechanism, particularly newsletters (43.5 percent vs. 21.2 percent), local school programs (33.9 percent vs. 12.1 percent), community relations departments (32.3 percent vs. 7.1 percent), private meetings with community leaders (32.3 percent vs. 8.1 percent), community meetings (32.3 percent vs. 5.1 percent), the internet (22.6 percent vs. 5.1 percent), and citizen surveys (16.1 percent vs. 2.0 percent).

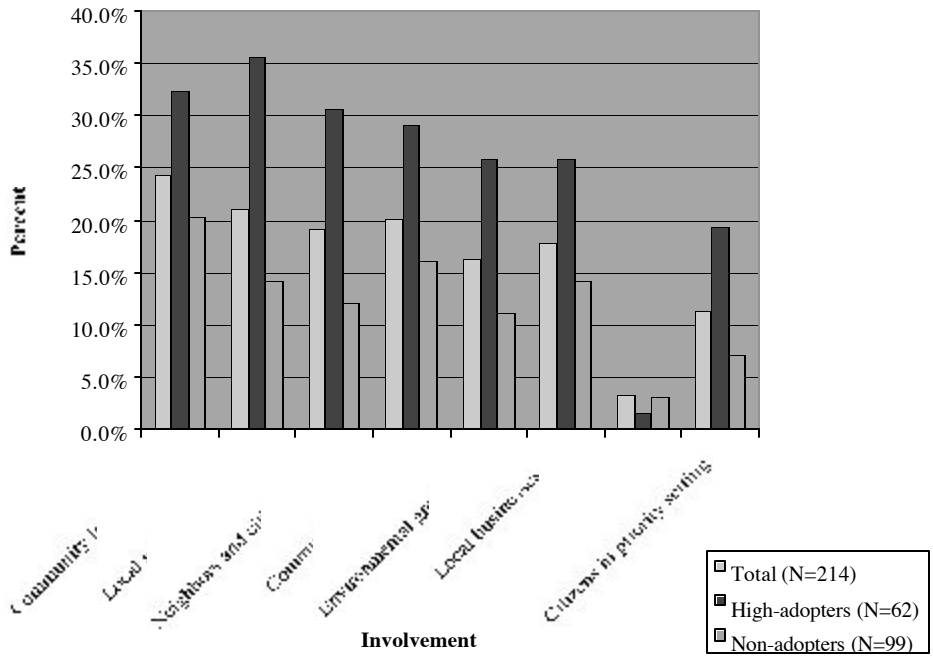
It is useful to focus in on more intensive modes of information sharing – such as face-to-face meetings. High-adopters were much more likely to engage community leaders through face-to-face meetings than non-adopters. High-adopters were four times more likely to engage in private meetings with community leaders – 87.1 percent versus 32.3 percent – and more than six times more likely to engage in broad-based community meetings – 32.3 percent versus 5.1 percent. High-adopters were much more likely to make use of Citizens' Advisory Councils (17.7 percent versus 4.0 percent) or to survey local citizens (16.1 percent versus just 2 percent).

Community Involvement in Environmental Program Development: Another way that plants can extend the basic principles of advanced environmental practices to communities is by involving community groups in the development of environmental programs. The survey examined whether or not high-adopters were more likely than non-adopters to involve communities in environmental activities and priority setting.

Figure 4 shows that high-adopters were more likely to report some involvement of community and government groups in their environmental program development than non-adopters, 32.3 percent vs. 20.2 percent. High-adopters were almost three times as likely to involve local neighbors and citizens – 30.6 percent versus 12.1 percent, and were more than twice as likely to involve local government – 35.5 percent versus 14.4 percent. They were also statistically significantly more likely to involve community groups (29.2 percent versus 16.2 percent), environmental groups (25.8 versus 11.1 percent), and local businesses (25.8 versus 14.1 percent).

The survey also asked respondents to rate the level of involvement of various groups on a 1-to-4 scale, with 4 being the highest level of involvement. High-adopters were far more likely to rate community groups at a high level than non-adopters (3.00 versus 2.38 for non-adopters – a statistically significant difference).

Figure 4: Community Involvement in Environmental Program Development

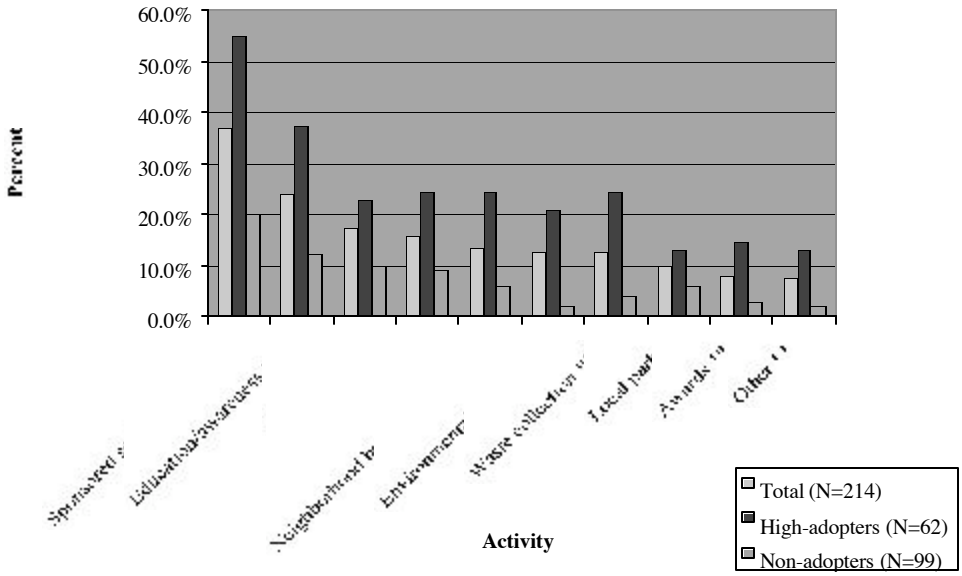


Source: Florida, et al, *Community Environmental Benefits Survey* , 1999

Sponsorship of Community Environmental Activities: The survey examined the nature and extent of community environmental activities sponsored by sample plants. Figure 5 shows the environmental activities sponsored by survey plants such as education programs, recycling programs, earth day events, and so on. As these data show, high-adopters were more likely to engage in a wide range of environmental activities with their local communities.

High-adopters were more than twice as likely to sponsor community activities than non-adopters – 54.8 percent versus 20.2 percent. They were three times more likely to sponsor educational awareness programs – 37. 1 percent versus 12.1 percent – and two times more likely to sponsor recycling programs or earth day events. They were four times more likely to sponsor neighborhood beautification programs, and over ten times more likely to provide grants for local environmental projects and activities. In every case, high-adopters were significantly more likely to sponsor the activity than non-adopters. The data also indicate that high-adopters were likely to support their commitment to activities with greater direct financial outlays. High-adopters reported spending considerably more financial resources on environmental activities than non-adopters – more than twice as much per firm, $12,750 vs. $5,666.

Figure 5: Community Environmental Activities



Source: Florida, et al, *Community Environmental Benefits Survey*, 1999

Change in Relationships with Communities: The survey asked respondents to report on the perceived changes in their relationship with the surrounding community. To get at this issue, the

survey asked for respondents' perceptions in the change in their relationship with the surrounding community over the past five years. Respondents were asked if they would classify relations as much improved, improved, unchanged, worse, or much worse over the past five years. These responses were converted to a five-point scale, where 5 was much improved and 1 was much worse.

The findings indicate that high-adopters were much more likely to report that their relationship with their community had either improved or become much improved. Nearly three-quarters of high-adopters (72.4 percent) reported that their relationship with the surrounding community was either improved or much improved compared to 44.6 percent for non-adopters. High-adopters reported a perceived average change of 4.03 against 3.57 for non-adopters (the overall rating was 3.75).

Another way to gauge the nature of the relationships between manufacturing plants and their surrounding communities is to examine the way that communities react to potentially sensitive proposals from those plants. The survey sought to obtain information from plants on their perceptions of how the community has responded to major plant initiatives such as permit applications, permit revisions, or plant expansions. The survey did this in order to identify specific types of plant actions that could provoke a negative community reaction. This allowed respondents to identify recent sources of friction with their communities and served as a check against excessively positive estimates of community relations.

High-adopters were much more likely to characterize their relationships with communities as "supportive." Generally speaking, between 80 to almost 90 percent of high-adopters reported that relationships with their communities were supportive in cases of plant expansion, new plant construction, environmental permit revisions, and new environmental permit requests compared to between 60 and 66 percent of non-adopters.

Summary Scores: We developed a series of "summary scores" to look at the overall picture of community involvement and relationships (see Table 4). The findings here indicate that high-adopters consistently outperformed non-adopters on this dimension. High-adopters scored three times higher than non-adopters in sponsoring community activities (with a score of 23.55 compared to 7.27), twice as high in information sharing with the community (37.48 compared to 18.60), and more than twice as high in involving the community in their environmental programs (16.56 compared to 6.77). Overall, high-adopters outscored non-adopters by a factor greater than two, 32.65 to 17.31. (All of these results are statistically significant). Generally speaking, we find that advanced environmental plants are more likely to share information with the community and to obtain input from community groups, neighbors and environmental groups in their environmental decision-making and priority setting. These community practices reflect the same basic principles of information sharing and employee involvement, which underpin advanced management systems. We thus find that advanced plants are able to learn from and extend the principles of advanced management practices to their dealings with local communities.

Community Impacts

The research sought to ascertain whether high-adopters were likely to pose less environmental risk and indeed to confer greater environmental benefits to the quality of the local environment than non-adopters. The short answer here again, is yes. The survey data indicate that high-adopters consistently reported posing less environmental risk and conferring more significant benefits in a wider range of areas than non-adopters.

Community Environmental Impacts: The survey asked a variety of questions designed to examine the environmental impacts of plants on communities. It focused on two types of environmental impacts – **direct environmental impacts**, including waste emissions and energy

use; and **indirect impacts** or environmental esthetics and quality-of- life issues such as odor reduction and improved plant appearance.

Overall, the survey results indicate that high-adopters pose less environmental risk and greater environmental benefits to their communities than non-adopters (see Figure 6). The survey data indicate that half of high-adopters reported having a positive community impact compared to 39 percent of non-adopters. Three more specific findings are particularly notable.

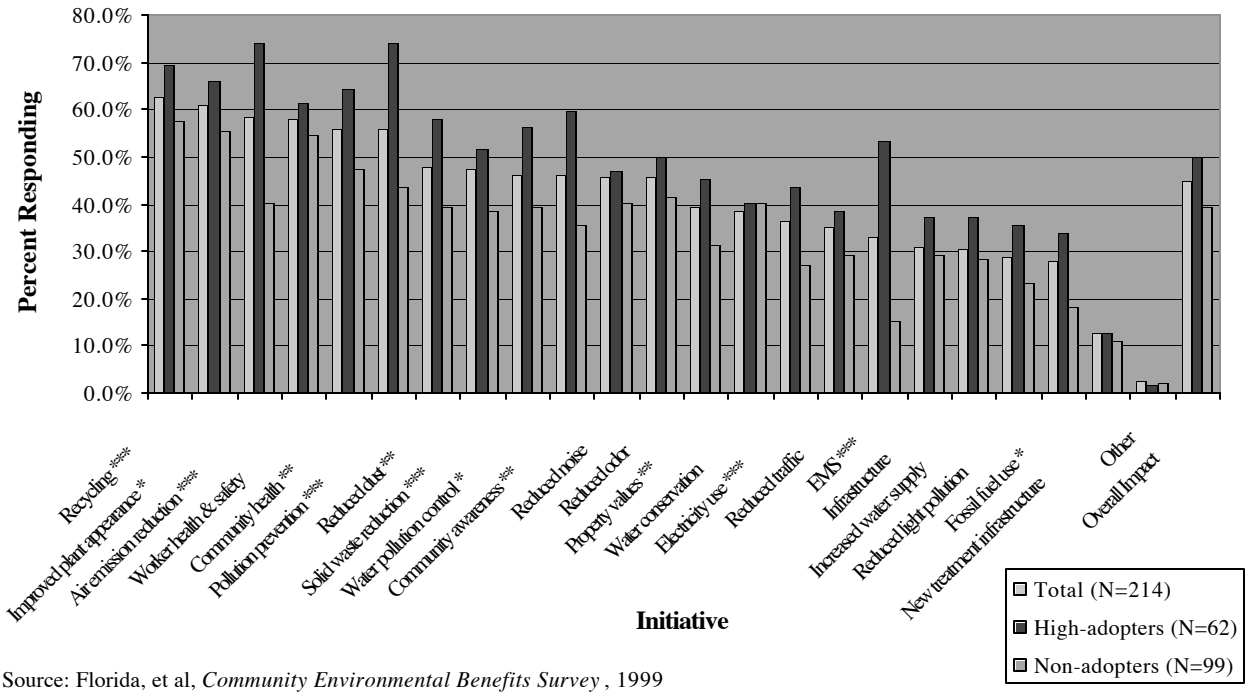
First, high-adopters were much more likely to see their use of EMS and P2 practices as a key factor in reducing community environmental risk and improving community environmental performance. Three-quarters of high-adopters cited their pollution prevention efforts as having a significant impact on community environmental quality compared to 43.4 percent of non-adopters. More than half of high-adopters reported EMS as having a positive impact on community environmental quality compared to 15 percent of non-adopters (both of these results are statistically significant at the.01 level). In addition, nearly 60 percent of high-adopters (59.7 percent) reported their efforts to increase community awareness of pollution prevention as having a significant positive impact on the environment compared to 35.4 percept of non-adopters.

Second, high-adopters were more likely to report significant direct community impacts through their emission reduction and elimination strategies. High-adopters were nearly twice as likely to report the following as sources of community environmental improvement: air reduction and elimination (74.2 percent versus 40.4 percent), solid waste reduction and elimination (51.6 percent versus 38.4 percent), energy use (43.5 percent versus 27.3 percent) use of fossil fuels (33.9 percent versus 18.2 percent), and water pollution control (56.5 percent versus 39.4 percent). High-adopters were also more like to report positive community impacts through recycling programs (69.4 percent versus 57.6 percent).

Third, high-adopters were more likely to report a positive impact on the local environment, through improvements in plant and community esthetics such as dust and plant appearance. Nearly 60 percent of high-adopters reported a positive impact through reduced dust

compared to 39.4 percent of non-adopters (statistically significant at the .01 level). Two-thirds of high-adopters reported a positive environmental impact through improved plant appearance compared to 55 percent of non-adopters (statistically significant at the .10 level). High-adopters were also more likely to report community benefits through increased local property values, 43.5 percent compared to 31.3 percent for non-adopters (statistically significant at the .05 level).

Figure 6: Community Impact of Environmental Initiatives



Source: Florida, et al, *Community Environmental Benefits Survey* , 1999

The survey also asked respondents to rate the level of community impact of various initiatives on a 1-to-4 scale with 4 being the highest level of impact. High-adopters were much more likely to rate Environmental Management Systems (EMS) as a source of community environmental improvement (3.43 versus 2.64 percent); this was the only response category that was statistically significant at the .01 level. High-adopters were also more likely to rate air emission reduction (3.18 versus 2.79) and fossil fuel use (2.83 versus 2.26) as sources of community environment improvement.

Comparing Community and Plant Environmental Impacts: The survey also enabled us to compare reported community environmental impacts with environmental impacts inside the plant. This allowed us to gauge whether there was any spillover to communities of innovative practices and procedures used inside advanced plants.

Before proceeding to a detailed discussion of these findings, two overall findings are particularly worth highlighting. First, the findings indicate that high-adopters reported more significant plant-level gains from their environmental initiatives. Second, and perhaps more importantly, the findings suggest considerable symmetry and overlap between practices that results in both plant and community gains, providing support for the hypothesis that advanced plants take what they have learned inside their factories and apply it to realize improvements in community environmental impacts.

More than three-quarters of high-adopters cited the following programs as major sources of in-plant environmental improvement: pollution prevention (95.2 percent), recycling (93.5 percent), reduction or elimination of air emissions (89.7 percent) worker health and safety (85.5 percent), environmental management systems (79.0 percent) and solid waste reduction and elimination (75.8 percent). High-adopters were nearly twice as likely to report pollution prevention as a source of plant-level improvement – 93.5 percent versus 69.7 percent; and they were more than three times more likely to view EMS as the source of significant in-plant improvement – 79 percent versus 28.3 percent. High-adopters were significantly more likely than non-adopters to cite the following as sources of in-plant environmental benefit: recycling (93.5 percent vs. 69.7 percent), air emission reduction (88.7 percent vs. 53.5 percent), solid waste reduction (75.8 percent vs. 54.5 percent), and electricity use (67.7 percent vs. 43.4 percent).

Comparing these results on plant level impacts to the findings on community environmental benefits leads to a useful and important conclusion. Here, we find that several of the most commonly identified sources of plant environmental impacts were also cited as sources

of community environmental impact. These include recycling, pollution prevention, air emissions reduction, solid waste reduction, electricity use, and EMS. This suggests substantial symmetry between the programs and initiatives that generate environmental benefits inside the plant and in the community. This lends additional support for the hypothesis that high-adopters are extending the basic lessons and efficiencies generated by practices and initiatives originally implemented inside the plant to their relationships with and environmental impacts on communities.

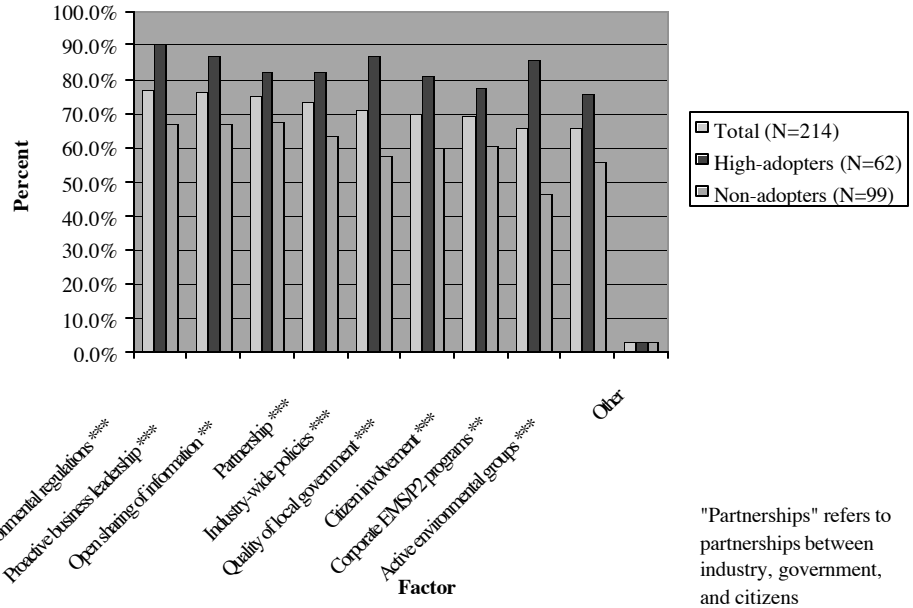
Employment Impacts: One of the most important ways that any manufacturing plant impacts the surrounding communities in by providing a source of employment for community residents. The survey asked respondents to estimate the overall affect of their environmental initiatives on plant employment, according to one of four outcomes: (1) eliminated jobs, (2) had no impact, (3) retained jobs that would otherwise have been eliminated, or (4) added new jobs. The survey findings indicate that high-adopters were much more likely to add or retain jobs as a result of environmental initiatives than non-adopters. More than half of high-adopters (56.2 percent) reported that they added or retained jobs as a result of major environmental programs and initiatives, compared to 26.3 percent of non-adopters.

Key Factors in Community Environmental Impact: The survey also obtained information on the key factors that plants believe have the greatest effect on their ability to positively impact the community environment. The survey asked respondents to identify and rate the importance of factors such as environmental regulations; business leadership; advanced environmental programs such as EMS and P2 programs; open sharing of information; constructive partnerships between business, government and citizens; quality of local government; active citizen involvement; and active environmental groups.

The findings indicate that high-adopters were more likely to identify all of these factors as important. More than three quarters of high-adopters rated each of these factors as important

compared to half to two-thirds of non-adopters. High-adopters in particular were much more likely than non-adopters to identify active citizen involvement and active environmental groups as important.

Figure 7: Factors Impacting the Quality of the Local Environment



Source: Florida, et al, *Community Environmental Benefits Survey* , 1999

The survey also asked respondents to rate their importance on these factors on a 1-to-4 scale where 4 equals most important. The results here are somewhat similar across the high-adopter and non-adopter groups. This is not surprising given that these ratings seek to capture differences in the level of importance among plants that have already identified these factors as important. It is worth pointing out that the largest level of difference is found in the relative rating of "corporate EMS/P2 programs." Indeed, this is the only factor where there is a statistically significant difference between high-adopter and non-adopters. High-adopters rated corporate EMS/P2 programs a 2.98 compared to 2.35 for non-adopters. This suggests that EMS/P2 programs represent a very important motivator for improving the local environment on

the part of high-adopters. These findings lend additional confirmation to the hypothesis that high-adopter plants are extending the innovative practices and initiatives they utilize inside the plants into their dealings with communities.

Summary Scores: We used "summary scores" to provide a broad assessment of the environmental risks and benefits plants pose for communities and to highlight the differential risks and benefits posed by high-adopter and non-adopter plants (see Table 5). The community impact scores indicate that high-adopters pose less environmental risk and potentially greater environmental benefits. High-adopters outscored non-adopters in overall community impact (30.36 to 22.37), direct community impacts, e.g. waste and emission reduction (28.19 to 20.71) and indirect impacts, e.g. environmental aesthetics (32.54 to 24.04). All of these findings are statistically significant.

Mechanisms for Plant-Community Spillovers

The field research findings supplement and reinforce the survey research results, providing clearer insight into the mechanisms through which plants extends the lessons and efficiencies associated with advanced environmental practices particularly and innovative management practices in general to their relationships with and environmental impacts upon communities.

One field research site drew upon its experience with advanced management practices to address a significant problem with odor. The plant had long generated noxious odors, which led to community complaints, government intervention and occasional shutdowns. Partly as a result of a change in ownership, the plant implemented an interrelated bundle of advanced management practices (e.g. team-based, employee involvement in decision-making, total quality management, an environmental management system, and ISO 9000 certification). It then applied and extended the principles and benefits associated with these practices to address this odor problem and its

broader relationship to the community. Traditionally, the plant had "sealed" itself off from the community, by not providing information in the event of an odor problem and even failing to respond to complaints. The plant implemented a system for immediately responding for community complaints by proactively supplying the community with information in the event of an odor problem and dispatching staff to consult with and seek input from community members. The plant encourages residents to call directly if they detect odors that they believe are coming from the plant. It responds to each odor complaint with an internal investigation and a phone call or visit to the caller with a report of findings. In this way, the plant extended its innovative techniques for quality management and employee involvement initiated inside the plant to dealings with neighbors and community leaders. County air quality inspectors report that they no longer detect a significant odor problem at the facility.

Another field research site has developed an environmental mission statement – "nature is our customer" – that both reflects and extends the principles that underpin its broader commitment to advanced management practices, such as, customer focus, quality, and continuous improvement. As part of its environmental priority setting, the plant conducts a survey of community residents' perceptions of environmental issues and needs. The survey includes a telephone survey of residents and face-to-face meetings with community residents and thought-leaders. It enables the plant to gather systematic information on community concerns and priorities in order to anticipate emerging issues and proactively address them before they become obstacles to business performance.

On a broader level, the fieldwork suggests the following mechanisms for adoption of advanced environmental practices. Plants initially build up experience and capability with innovative management practices (such as total quality management and employee-input in decision-making process) targeted at improving internal business performance. As these practices produce gains, plants begin to apply elements of them in their environmental systems, for example by adopting environmental management systems or pollution prevention programs

which are based on the same underlying principles of information-sharing, employee-input, and performance measurement. They then seek to apply the principles associated with these internal systems to their relationship with the external community, in effect, extending these systems and practices across the factory gate to include their dealings with and environmental impacts upon local communities.

CONCLUSIONS

This study has examined the hypothesis that there are spillovers between environmental practices that are the source of performance gains inside business organizations and those that confer benefits to the external community. Our underlying theory is that business organizations that have realized improvements in their own, internal industrial and environmental performance will seek to apply these advanced practices in dealing with local communities. These organizations thus extend the basic principles of innovative management strategies such information sharing, worker involvement, and minimizing defects and waste across the factory gates to include their relationships with and impacts upon local communities. To test this hypothesis, the study conducted a survey of 583 manufacturing plants.

The key findings of this study confirm the hypothesis. We find evidence that advanced, high-adopter plants tend to extend the basic lessons and efficiencies of practices originally implemented inside the plant to communities. The findings inform three more specific conclusions.

First, the findings suggest a considerable overlap and symmetry between of advanced environmental practices and innovative management practices in general. High-adopter plants – that is EMS/P2 adopters – are considerably more likely than non-adopters to utilize a wide range of advanced management practices, ranging from ISO 9000 certification to employee involvement in the management process. These plants tend to be more innovative overall.

Second, the findings indicate that the basic principles of innovative management practices (e.g. information sharing and input from key stakeholder groups) tend to spillover into dealings with communities. Advanced, high-adopter plants are significantly more likely to share information with community and environmental groups and obtain input from these groups in their environmental decision-making and priority setting.

Third, high-adopter plants appear to extend the benefits of in-plant environmental performance improvement to effectively reduce waste and emission streams that pose environmental risk to the communities in which they are located. The survey findings indicate that high-adopter plants appear to pose less environmental risk and generate more positive environmental impacts in the communities in which they are located. These plants tend to generate more significant community environmental improvements than non-adopters both in terms of waste and emission reduction and esthetic issues such as odor and plant appearance

In the end, we believe that our research has identified an interesting problem – the way that innovative organizational practices can spillover to the relationship with surrounding communities. Additionally, we certainly want to note that this is a big problem where much more work needs to be done. We want to encourage other researchers who are interested in environmental performance, advanced management practices, and organizational strategy to begin to look at this problem and to undertake additional survey and field research in this important area.

BIBLIOGRAPHY

Richard N. L. Andrews, *Managing the Environment, Managing Ourselves* (Yale University Press, New Haven CT: 1999).

Mark Atlas and Richard Florida, "Green Manufacturing," in Richard Dorf (ed.), *Handbook of Technology Management* (CRC Press: 1998).

Mark Atlas and Richard Florida, "Why Do Firms Adopt Green Design? Organizational Opportunity, Organizational Resources, Costs, or Regulations" (unpublished working paper, Carnegie Mellon University, Heinz School: 1997).

Keith D. Denton, *Enviro-Management: How Smart Companies Turn Environmental Costs into Profits* (Prentice Hall, Englewood Cliffs NJ: 1994).

Patricia Dillon and Kurt Fischer, *Environmental Management in Corporations: Methods and Motivation* (Tufts University Press, Medford MA: 1992).

Richard Florida, "Lean and Green: The Move to Environmentally Conscious Manufacturing," *California Management Review*, 1996, 39/1, pp. 80-105.

Richard Florida, Mark Atlas, and Matt Cline, "What Makes Companies Green? Organizational Capabilities and the Adoption of Environmental Innovations" (Association of American Geographers: 1999).

Richard Florida and Davis Jenkins, "The Japanese Transplants in North America: Production, Organization, Location, and R&D," in Steven Tolliday (ed.), *Between Imitation and Innovation: The Transfer and Hybridization of Production Systems in the International Automobile Industry* (Oxford University Press: 1998), 189-215.

Stuart Hart and Gautum Ahujba, "Does it Pay to be Green? An Empirical Examination of the Relationship between Pollution Prevention and Firm Performance," (unpublished paper, University of Michigan School of Business Administration: 1994).

Casey Ichniowski, Kathryn Shaw, and Giovanna Prennushi, "The Effects of Human Resource Management Practices on Productivity," draft manuscript (Columbia University, Carnegie Mellon University, and the World Bank: 1993).

Davis Jenkins and Richard Florida (1999), "Work System Innovation among Japanese Transplants in the United States," in Paul Adler, Mark Fruin, and Jeffrey Liker (eds.), *Remade in America: Japanese Transplants and the Diffusion of Japanese Production Systems* (Oxford University Press, New York: forthcoming).

John Paul MacDuffie, "Human Resource Bundles and Manufacturing Performance: Flexible Production Systems in the World Auto Industry" (Wharton School, University of Pennsylvania: 1994).

James Maxwell, Sandra Rothenberg, and B. Schenck, "Does Lean Mean Green: The Implications of Lean Production for Environmental Management" (International Motor Vehicle Program, MIT: 1993).

Michael Porter, "America's Green Strategy," *Scientific American*, 1991.

Michael Porter and Claas van der Linde, "Green and Competitive: Ending the Stalemate," *Harvard Business Review*, 1995a, pp. 120-134.

Michael Porter and Claas van der Linde, "Toward a New Conception of the Environment-Competitiveness Relationship," *Journal of Economic Perspectives*, 1995b, 9/1, pp. 97-118.

Stephen Schmidheiny, *Changing Course: A Global Business Perspective on Development and the Environment* (MIT Press, Cambridge MA: 1992).

Johan Schot, "Credibility and Markets as Greening Forces for the Chemical Industry," *Business Strategy Environment* 1, 1992, pp. 35-44.

Kurt A. Strasser, "Preventing Pollution," *Fordham Environmental Law Journal*, VIII, Fall 1996, pp. 1-57.