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### The Evolution of experimental programs in the printing industry

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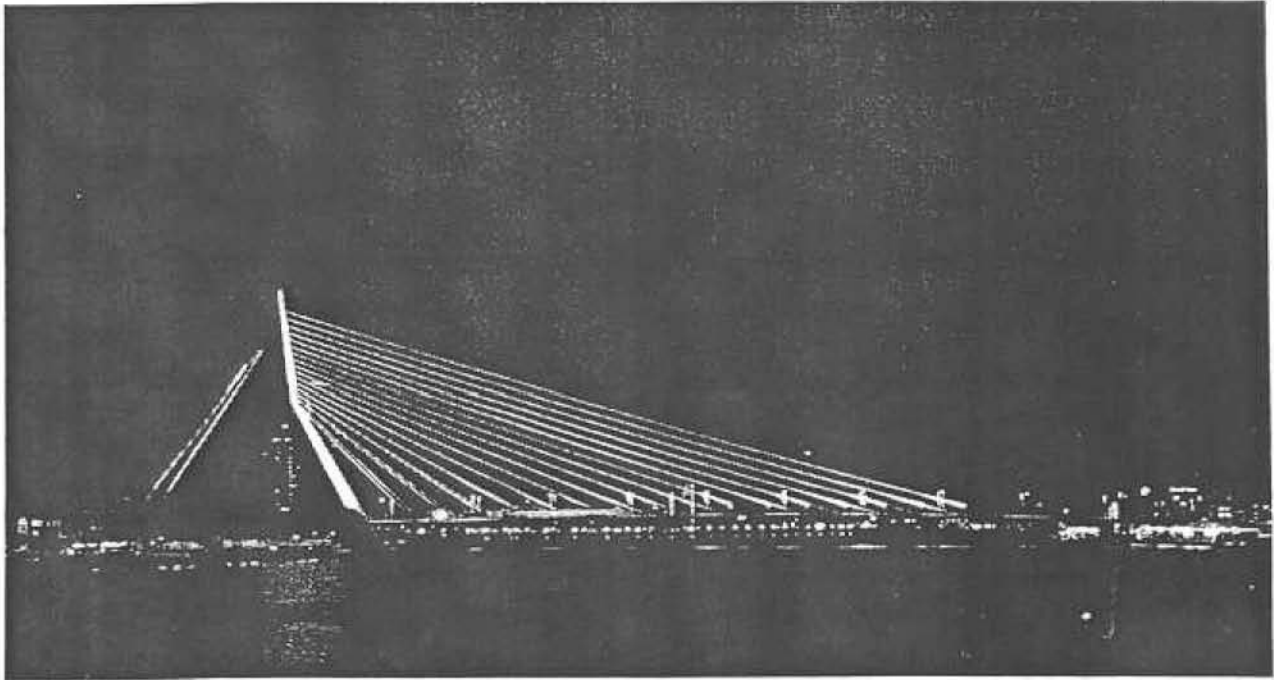
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## The Evolution of Experimental Environmental Programs in the Printing Industry

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In the 1990s there was an explosion of experimental technical assistance programs at the national, state and local levels. These programs were designed to promote compliance (for those firms that needed to comply) and pollution prevention. Promoting the adoption of environmentally friendly technologies in small firms, however, has been difficult. The goals of this paper are to examine how environmental programs in the U.S. for small businesses have evolved over the past two decades and to begin to explore the effectiveness of these programs from the perspective of small companies.

When developing programs to promote the adoption of environmentally friendly technologies in firms, doing so in small firms is particularly difficult (US GAO 2001). Several researchers have found that smaller firms tend to face greater challenges in meeting and exceeding regulatory requirements (Yeager 1987; Crain and Hopkins 2000; Dean, Brown et al. 2000). It is difficult to get the appropriate information and knowledge to these smaller firms and to enable them to implement solutions. Recognizing these challenges, numerous experiments are being conducted at the federal, state, and local levels of government aimed at improving environmental outcomes in small firms, with and without regulation.

Since the mid 1980's, the U.S. Environmental Protection Agency and state level environmental agencies have relied on a variety of voluntary programs emphasizing technical information and direct assistance to encourage pollution prevention technology diffusion in small companies. Government agencies are constantly evolving these programs to make them more appealing to small businesses in the hopes of drawing in more firms. These experiments may be forming the foundation of a next wave of environmental policy. Evidence of the success of these programs tends to be anecdotal, however, making it difficult for researchers and policymakers to evaluate their benefits and to develop organizational models of successful programs.

The goals of this paper are to examine how environmental programs in the U.S. for small businesses have evolved over the past two decades and to begin to explore the influence of technical assistance programs on the environmental choices of small companies. We draw our insights from the printing industry, a sector where small firms predominate. After a brief overview of the U.S. printing industry, we review how government involvement with small printers has evolved historically. We then review survey, interview, and secondary source data to assess the effectiveness of these programs. Lastly, we discuss how a new phase of government experimentation and involvement is emerging in response to the challenges faced by the first generation of voluntary assistance programs.

### The Printing Industry

The printing industry is comprised of approximately 62,355 firms, with sales of approximately \$210 billion annually. (1997 estimates; U.S. Census Bureau, <http://www.census.gov>.) This industry is a significant contributor to the overall U.S. economy. Historically, this industry has also been a fair contributor to the environmental impacts created by U.S. manufacturing industries as well. According to the 2000 Toxics Release Inventory (TRI), the 202 printing firms that reported under this program released 19 million pounds of toxic chemicals to the environment in one year. (<http://www.epa.gov/tri/tridata/tri00/index.htm>.) Note that this number includes only those 202 (out of over 60,000) firms large enough to require TRI reporting. Once the vast number of smaller firms is considered, the environmental impact is no doubt significantly larger.

The prevalence of these small and medium sized firms was one of the primary motivators for choosing the printing industry as the focus of this study. Pressure from both government and society has been focused on larger firms. Similarly, research on environmental management, regulation, and performance has primarily focused on larger firms. One of the primary reasons is that the most popular measure of performance used in this type of research, TRI Emissions, is by its nature exclusionary to small firms.

Numerous regulatory and non-regulatory initiatives have sought to propel the printing industry toward better environmental performance with regard to air emissions, either through enhanced pollution control or adoption of greener manufacturing technologies and practices. These programs represent a range of strategies for affecting environmental behavior, some more traditional than others. Without doubt, these efforts represent a significant investment of both public and private resources and are worthy of close examination to better understand whether and how these programs are having an impact on the environmental performance of printing firms.

### Method

#### Survey

The quantitative data comes from a survey panel of 565 printers who volunteered to participate in a series of on-line surveys administered by the RIT Sloan Printing Industry Center. (The panel was created by inviting a sample of 10,500 printers and packagers selected from the Dunn and Bradstreet database. The sample was chosen to represent the variety of printing technologies and firm size. All firms with 20 or more employees are included in the sample (approx. 5,000). In addition, 50% of firms with between 10-19 employees and 15% of the firms with 9 employees or less were randomly selected.) Participants were offered incentives, such as early access to results, written material, and a free on-line class. Out of the 565 plants in the panel, 128 printing plants participated in this particular survey. Respondents were asked to report their knowledge of and perceived usefulness of a number of industry and government technical assistance programs. A number of control variables, such as size, type of technology, age, attainment classification, etc. were also measured.

#### Qualitative Data Collection

In addition to the survey data, we conducted several interviews with printers and program managers of a variety of technical assistance programs. In order to attain more detailed information on the day to day management of environmental waste at a printing shop, one in-depth case study was done at a small printer. These interviews served to give us more information on the goals and practices of the technical assistance programs, and the printer's perceptions of these programs. Interviews were either taped and transcribed, or notes were typed up immediately after the interview in order to retain as much as the information as possible.

### The Evolution of Government Involvement

#### Small Firms in the Fray

The ways in which the government has managed the environmental impacts of small printers has evolved over time. Prior to the 1980's, while small printers were regulated primarily through operating permits, oversight by environmental agencies was considerably more lax than that of their larger counterparts. There were several basic assumptions that drove this policy. First, perhaps because they were less visible, small sources seemed to have a relatively insignificant impact on the environment compared to larger companies (Schaper, 2002).

Second, and perhaps more important, many argued that regulation was too taxing for small business. Quite simply, small businesses do not have the financial or technical means to comply with regulation. There was a concern that requiring complex paper work and pollution control equipment for small sources would have the effect of driving small companies out of business. There is substantial research that supports this view. Small firms, for example, often lack risk-bearing capital, technically qualified personnel, or adequately educated and well informed management (Schmidt 1990). Because of these disadvantages, research suggests that it is smaller firms that have greater challenges in meeting and exceeding regulatory requirements, especially for changes that require the implementation of costly new technology (Yeager 1987; Crain and Hopkins 2000; Dean, Brown et al. 2000). Dean, et al. (2000), for example, argues that there is an overall higher unit pollution abatement cost associated with small firms. First they suggest that compliance asymmetries occur when regulations are equally applied and enforced across small and large firms. In this situation, asymmetries result from differences in compliance costs per unit output between small and large firms. Moreover, the larger firms have an advantage in defending themselves due to greater legal resources as compared to that of the small firms.

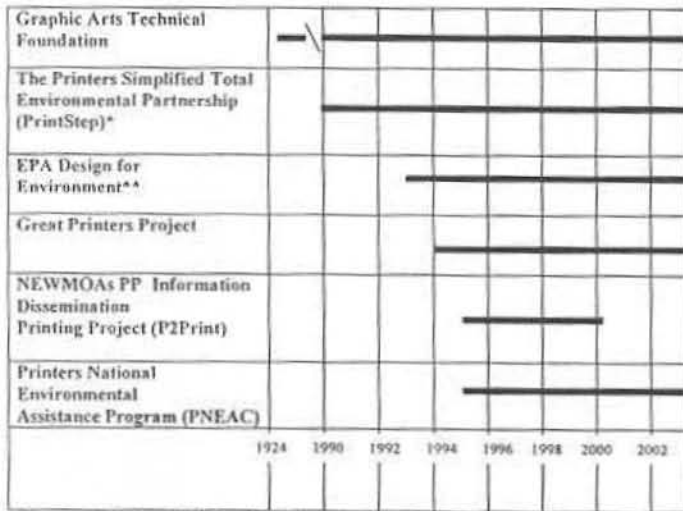
Third, regulation of small firms was not only too costly for firms, but also the government. The cost of monitoring the multitude of small companies was simply too high and administrators thought that government resources should be focused in order to get the "biggest bang for the buck." This meant that historically government regulations focused on larger firms and, to a large extent, ignored smaller firms.

#### The Growth of Technical Assistance Programs

In the 1980s, however, these assumptions started to change. As larger, regulated firms started to reduce their pollution and better manage the environmental function, regulators realized that collectively small firms could have a significant impact on the environment and could no longer be ignored. Moreover, if small firms had the correct information, they could adopt pollution prevention practices. This would not only improve their environmental performance, but also help their operational efficiency as well. The key problem, most people thought, was that small firms simply did not have access to technical information on pollution prevention. As discussed by Rogers (Rogers 1983), the first stage of any diffusion process is that firms need to be exposed to the existence of the alternative technology and gain an understanding of its form and function. Information dissemination, therefore, was one of the primary purposes of many formal technical

assistance programs, both at the government and industry level. The logic behind these programs was that the greater access firms have to information on pollution prevention technology, the more likely they will be to adopt these technologies (US GAO 2001).

As a result of these changing assumptions, there was an explosion of experimental technical assistance programs at the national, state and local levels. These programs were designed to promote compliance (for those firms that needed to comply) and pollution prevention through a variety of mechanisms including site assessments, workshops and video-conferences, technical literature development and dissemination, and focus groups. Figure 1 outlines some of the programs that were created specifically for printers.



\* Known as the Common Sense Initiative from 1990-2000

\*\*Flexographic Printing Project started in 1996

Figure 1: A Selection of Programs Created to Assist Small Printers

### Findings

The question remains, to what extent have these programs been able to influence the diffusion of new environmentally superior technologies? In our survey, respondents were asked to report the degree to which a variety of sources provided useful information on environmentally superior technology? Respondents were given a scale of 1 to 5, with 1 meaning not useful at all and 5 meaning extremely useful. Many printers reported that they do not consider state and federal government programs as useful sources of environmental information. As can be seen in Table 1, the most influential sources of environmental information were instead other companies, such as suppliers, competitors, trade associations, and even customers.

Organization	Mean	SD
Equipment Suppliers	3.0	1.27
Ink Suppliers	3.0	1.27
Trade associations	2.9	1.3
Fountain Solution Suppliers	2.7	1.33
Other Printers	2.4	1.19
Substrate Suppliers	2.2	1.24
Customer	1.9	1.14
State Government	1.6	.98
Federal Government	1.5	.74
POTW	1.3	.67

Table 1: Usefulness of Various Types of Organizations for Providing Information on Environmental Technologies

Additional analysis (T tests comparing firms below and above 10 employees in size) revealed significant differences across firm size. Larger printers, for example, were more likely to find government sponsored technical assistance programs more useful than smaller firms. Larger firms also reported greater usefulness of all potential information sources and significantly higher use of trade associations and suppliers. One explanation for this is that larger firms have greater resources and are more involved with trade associations and other networks, giving them greater access to potential sources of information. The relationship, however, while not as strong, was still there when controlling for membership and activity in trade associations. This suggests that smaller printers, although they are the most in need of these programs, are also the least likely to find them useful.

When asked about specific organizations that provide information about environmental technologies, several interesting findings emerge. The same question was posed; "To what degree have the following sources provided useful information on environmentally superior technology (i.e. information that has led to active exploration of a new technology within your company)?" Because we were asking about specific organizations, however, respondents were given the option to indicate that they were unfamiliar with the program. For all programs other than the Graphic Arts Technical Foundation (GATF), between one third to one half of the respondents reported that they were unfamiliar with the organization in question. This indicates that a significant percentage of the industry has no knowledge of the environmental programs targeted specifically to their industry. Second, of the firms familiar with these programs, from 60 to 84% of the firms find them not at all useful. Again, GATF is the exception, with only 28% saying that they are not at all useful. Unlike the first five programs listed, the GATF was the only organization that is an industry association. It also traces its beginnings as far back as 1924 and is a member organization with a mission that is much broader than the others. Supported by a partnership between the GATF, the EPA, University based technical assistance programs, and the Printing Industries of America (PIA), PNEAC had a surprisingly high 45% of firms respond that they were unfamiliar with the organization. For those that were familiar with it, however, it was the organization reported to provide the most useful information.

		EPA, Technical DfE (1)	State Technical Assistance Programs (2)	MEP (2)	Local Small Business Assistance Program (3)	PNEAC (3)	Graphic Arts Technical Foundation
Unfamiliar		41%	30%	36%	18%	45%	12%
Familiar		59%	70%	64%	82%	55%	88%
Of Firms that are Familiar,	Extremely Useful	2%	30%	36%	18%	45%	12%
	↓	5%	70%	64%	82%	55%	88%
	↓	8%	3%	3%	2%	0%	11%
	↓	10%	4%	0%	4%	2%	22%
	Not Useful At All	75%	13%	3%	8%	9%	23%

1. U.S. Environmental Protection Agency, Design for Environment Program
2. National Institute of Standards and Technology, Manufacturing Extension Program.
3. Printers' National Environmental Assistance Center

Table 2. Usefulness of Specific Organizations for Providing Information on Environmental Technologies

Interviews with printers and program managers offered several explanations as to why firms did not view government funded technical assistance programs as useful sources of information. First, some printers did not feel that the information provided by these organizations was contextually relevant. As explained by one printer, "Yes, I read all of [the pollution prevention information from the government] - but what I question is how accurate and applicable it is in our specific situation. You know the junk that the government gives out... [We got our information] mostly from our vendors. The regulators just don't know enough about technology." In another study, Bierma and Waterstraat (1995) also found that businesses are more likely to see suppliers, competitors, and accountants as sources of credible information regarding new technologies, rather than government assistance programs.

In addition to credibility and technical accuracy, existing models of technology diffusion are increasingly pointing to the importance of "social capital" in encouraging diffusion of new technology within industries. This research places a greater focus on the importance of personal familiarity, professional networks, and trust in getting firms to use information to adopt new technologies (Fountain 1998; Adler, Kwon et al. 2001; Adler 2002; Adler and Kwon 2002). Since all innovations carry some uncertainty, the individuals within a firm feel a need for social reinforcement of his or her attitudes toward the idea (Rogers 1983). Given this need, information from peer groups is simply seen as more reliable than others.

Regulatory sources not only operate with less social capital, but are even seen as a source of danger to some firms. Although changing in some circles, government is still seen by most firms as being hostile to firms (Lindsey 1998). As a result, those firms that need help the most are least likely to go to government sponsored programs. As explained by one person from the EPA "If you're in decent shape from... a regulatory compliance perspective, then you're more likely to have a technical assistance provider, someone to come in and work with you on pollution prevention. But, if you've got problems you don't want anyone in your shop." At the state level another program manager explained: "Even though we're with ... the non-regulatory section [of the government], I think when we come and knock on their door, [printers] automatically think the worst."

#### Reforming Government Involvement with Small Printers

Faced with these setbacks, government involvement continues to evolve as agencies are starting government with new approaches to technical assistance. These efforts have been fueled by the

growing recognition that the combined environmental impact of small firms can be significant, especially when they are not controlling pollution as well as larger firms. This is particularly true in certain notorious sectors - dry cleaning, photoprocessing, and printing. These sectors are dominated by small firms that use and emit particularly problematic chemicals such as perchloroethylene, silver-bearing chemicals, and high VOC fountain and cleaning solutions.

One of the most common approaches being taken is to foster increased Industry/Government cooperation. Regulators realize that they are often not viewed as the most credible sources of information, and that partnering with more credible sources, such as trade associations, can be one way to increase their credibility. The most prominent example of this is the Printers' National Environmental Assistance Center (PNEAC), a partnership between the EPA, University based technical assistance programs, the Graphic Arts Technical Foundation (GATF), and the Printing Industries of America (PIA). This partnership has led to the development and dissemination of a wide range of printed and video-based information products, regulatory and pollution prevention oriented list-serves, conferences, and referrals to technical and regulatory experts. As shown earlier, this was the program that companies reported to be the most useful in their efforts to adopt new environmental technologies.

Some programs are also exploring ways to include suppliers in government program partnerships. Given our survey findings, this could be a promising way to encourage the adoption of new environmental technologies. The EPA Design for Environment Program, for example, has involved suppliers in a significant way in evaluating and disseminating information on alternative technologies for a variety of industries, including printing. One EPA official noted that suppliers could play an important role in educating their customers about environmental technologies, but they often lack the vocabulary or will to do so. This is even the case when suppliers have environmentally superior technologies in their portfolios. Typically, if environmental issues are raised by the sales force, they are usually limited to regulatory compliance issues and Material Safety Data Sheets. Working with suppliers could increase their skills in this area, and provide businesses with information that is, in the eyes of the industry, more credible than if just coming from a government source.

Another important lesson is that from a small printer's perspective, the first level of concern is compliance assurance. Until firms feel that they are not in danger of being found in violation of regulations, they will typically be unwilling to work with government partners on proactive pollution prevention projects. There is recognition on the part of regulators, however, that if small companies are to be included in the regulatory fold, innovative approaches are needed to ensure that compliance programs are efficient both from the perspective of the regulatory and regulated community. State regulators are dealing with lean budgets and know that they cannot afford to regulate and inspect the multitude of small firms. Moreover, small businesses are considered the engine of the economy and it can be politically treacherous to overburden them with regulation. Therefore, there are several programs emerging that are experimenting with alternate forms of regulation for small printers.

An important aspect of these new regulatory initiatives is that participating firms can clarify their compliance status and move on to obtaining technical assistance for pollution prevention activities. The Massachusetts Environmental Results Program, for example, is a self-certification-based program for small business. The program consists of industry specific standards for small business, but no permits. Technical assistance is provided to aid in self-certification and compliance is assured through review of self-certification documents and some inspections. By participating in the program, small firms also gain an access route to pollution prevention technology, without the threat of traditional regulation. New Hampshire PrintStep is a multi-media, self-certification program aimed at small printers, although already regulated medium and large firms can participate in PrintStep and take advantage of efficiencies of the multi-media permitting aspect. As part of the program launch, small printers were given full amnesty for past behavior, coupled with assistance to come into compliance. With the peace of mind that this clarification brings, the hope is that these firms will be more likely to seek out technical assistance for pollution prevention.

## Conclusions

In this paper, we discussed how government has evolved in the way it interacts with small business in the printing industry. Since the mid 1980's, the U.S. Environmental Protection Agency and state level environmental agencies have relied on a variety of voluntary programs emphasizing technical information and direct assistance to encourage pollution prevention technology diffusion in small companies. An assumption running behind many of these efforts is that diffusion is largely determined by making information more available to the industry. As noted by Geroski (2000, p.621) "The bottom-line seems to be that diffusion is a problem which public policy can ameliorate with a judicious mix of information provision and subsidies."

This study suggests that there are numerous factors that influence the ability of this information to actually facilitate pollution prevention adoption in small companies. Compliance uncertainty, doubts as to the credibility of the information, a general lack of trust between government and industry, and lack of resources to access and process this information all have hampered the effectiveness of some of the existing programs. We point to several ways in which the EPA and others are experimenting with ways to make these programs more effective.

It is important to place a qualifier on these findings. First, the survey results are limited to the extent that the sample is limited. There was a bias towards relatively large printing firms in the sample (i.e. the population of larger firms was higher in the sample than in the real population) though a large printer by our definition (i.e., over 100 employees in this analysis) is still a small firm by most standards. It would be helpful, therefore, to increase the number of small firms in the sample. There may also be some level of self selection bias in terms of who filled out the survey: If anything, however, it is likely that the results may be overly optimistic, as firms with more resources and more interest in attaining external information in exchange for completing the survey are more likely to participate in scouting activity. This is not to say, however, that the programs discussed in this paper are not working at all. There are numerous success stories of environmental improvements that have occurred as a result of these programs. In addition, many of these programs were started as experiments, and were meant to be part of a learning process. Assessing their success may only be possible after we can see the learning that evolves from them. Lastly, our survey did not focus on compliance assistance, even though that is a goal of some of the programs. It is very likely that government programs are more effective at assisting small firms with compliance questions, an area in which credibility is less of an issue (although fear and trust can still be).

We also make some additional suggestions for future changes in policy based on our research. Working with suppliers, for example, could be a critical avenue to increase effectiveness of technical assistance programs. Another way that programs can increase the relevance of their information is to couple them with more localized technology demonstrations at peer firms, involving suppliers. For most companies, trying out the new technology or seeing a peer using it is a critical step in forming an adoption decision. Methods to facilitate the trial of innovations will usually speed up the rate of adoption (Rogers, 1987). Alternatively, technology demonstrations at an independent testing facility with the ability to conduct side-by-side comparisons of alternative technology is preferable to testing in a vendor's facility. In a surface cleaning technology demonstration program, researchers found that firms relished the opportunity to conduct hands-on testing of their own parts in a piece of production-scale process equipment as a means of gathering evidence of the suitability of a new technology to their operation (Becker, Green et al. 2002).

As a last thought, Geroski (2000) offers a model of the diffusion process, in which the primary limitations to diffusions lay within firms. This suggests that the role of government may be even broader than facilitating information flow from suppliers to small and medium sized printers. Policies aimed towards building human capital may be just as effective. This assumption also suggests that there are limits to public policy in this area, since there are limitations on the extent to which policy makers (particular environmental policy makers) can actually change the management practices of a firm.

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