HIGHLIGHTS AND INSIGHTS: POLLUTION PREVENTION IN MID-SIZED FIRMS

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Georgia's technical assistance programs (TAPs) provide consultation services to industry on business management practices, manufacturing technologies, regulatory compliance, energy efficiency, and pollution prevention. Historically, these third-party TAPs evolved to assist smaller firms through on-site assessments, training courses, telephone consultations, and printed materials geared towards solving specific problems. With the exception of the worker health and safety program, the industries receiving assistance are not ranked or screened according to specific economic or environmental goals in the state. Two important trends impact these technical assistance programs. First, limited state-level funding places publicly funded programs under increased scrutiny and increases expectations that these programs address broader social goals such as enhanced economic competitiveness or improved environmental quality. And second, this broader view of the TAP's role in meeting social, as well as the individual firm's, goals implies more systemic and integrated approaches to assessing and assisting industry. In order to meet these broader social goals, this paper proposes changes in (or additions to) the traditional pollution prevention TAP clientele and methodology.

Characteristics of Mid-Sized Firms

The characteristics of mid-sized firms provide an opportunity for a pollution prevention TAP to meet the state's broader environmental goals more efficiently (by assisting fewer firms to achieve similar improvements in environmental quality). Compared to smaller firms, mid-sized firms collectively have a more significant impact on the environment. They are characterized by more complex decision making structures---the environmental managers are less directly involved in decisions regarding corporate performance goals, product and process design, production operations, and customer relations. On the other hand, better performing mid-sized firms are flexible, entrepreneurial, and risk-taking in terms of their responsiveness to customer needs and making changes in their products. They are more innovative than larger firms and distinctive in that they tightly define their products and markets and become dominant within them (Kuhn, 1982). They do share some common characteristics with smaller firms which make them good candidates for technical assistance: they have more financial and human resources constraints than larger firms and are more dependent on external sources of information (Staudt et al., 1994).

Mid-Sized Firms in Our Study

The study focused on mid-sized firms (corporations with between 2 and 30 facilities nationwide) that are potentially eligible for the U.S. EPA 33/50 Program (e.g., reported releases to the Toxic Release Inventory of any of the 17 toxics targeted by that program). A sample of 1,529 firms from six states---Florida, Georgia, Louisiana, North Carolina, Tennessee and Texas---were selected for review and account for over 60% of all facilities in the 13 states in EPA Regions IV and VI. The firms were surveyed by mail using a questionnaire designed to gather basic information on pollution prevention in the facility. The response rate was 40% overall.

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Some findings about pollution prevention in mid-sized firms:

- Pollution prevention planning is less integrated across the facility than in larger firms. Mid-sized firms report involvement of environmental specialists and facility managers more often than process/production specialists and shop floor employees.

- They are more dependent on externally generated methods for identifying pollution prevention options: including published literature, trade associations, non-regulatory TAPs, and other forms of free outside assistance (e.g., vendors).

- They are less likely to use internally derived methods for identifying pollution prevention options: including quality teams, self-initiated assessments, and employee recommendations.

- The most important reasons they cite for implementing pollution prevention are regulatory compliance, worker health and safety, and liability.

- They are concerned about funding, product quality, and regulatory impacts associated with pollution prevention projects.

A Few Mid-Sized Firms That Do Pollution Prevention

The second phase of our study involves the development of detailed case studies of four mid-sized firms. The results of the case studies reported here are preliminary. The cases were drawn from the sample of firms receiving questionnaires in the first phase of this study. The selection was performance based; that is, we wanted to evaluate firms across several states and industrial sectors that had prevented a "significant" amount of pollution in the past four to five years. A "significant" amount of pollution prevention, however, is context specific. For that reason, we compiled a list of approximately 20 candidates with guidance from state regulatory and technical assistance staff. We contacted the company environmental managers by telephone to discuss the study and, with their support, sent letters of invitation to the plant managers.

In the case studies, we collected information about the corporate culture, values and attitudes, the internal organizational factors, the external factors, and decision making style of a variety of companies that had prevented pollution. Ideally, we wanted to interview as many participants in the decision making process as possible, from the shop floor to the plant manager. We requested interviews with the plant manager, production or operations manager, environmental manager, financial manager, human resources manager, and general workers. We reviewed background information on the case study companies from multiple information sources, including: chemical release data from the Toxic Release Inventory; financial data from published sources such as Dun and Bradstreet, Standard and Poors, and Moodys; and general corporate literature produced by the case companies. We developed a survey with open-ended questions and made further refinements by rehearsing the interview process with the team of three interviewers.

Some of the most interesting characteristics shared by the case study firms can be best illustrated by comparing and contrasting two of the them. Both of these companies achieved significant reductions in pollution and were recognized by their state agencies for their efforts. The first company (Company A) manufactures parts for the automotive industry. It was significantly impacted by the quality movement in that industry and established a comprehensive total quality management program several years ago. The company uses state-of-the-art manufacturing technologies and was spotless. The second company (Company B) also manufactures a transportation industry-related product. The production processes are older (some World War II vintage equipment) and the plant was quite grungy. During the period of this company's most significant reductions in hazardous waste, the managerial style was quite dictatorial (the total quality management program is in its infancy). On first inspection, one would not have guessed that this company had received an environmental award.

1. Participatory Management Style. Company A had a mature TQM program and a formal team approach to identifying ways to improve efficiencies and reduce environmental impacts. It had an impressive communication program consisting of regular meetings, "touch-screen" computerized information kiosks, a newsletter, and an award program. Company B was more interesting. In spite of an acknowledged dictatorial management style, this company exhibited a more participatory approach in its organizational culture. In this industry, considerable respect is accorded to those with the most shop floor experience (the production superintendents are promoted from the shop floor). This

level of respect was evident at all levels in the facility from the shop floor to the plant manager. These experienced "elders" exerted influence through informal and formal communication channels. Their experience with the manufacturing processes and loyalty to the company gave them a voice in the decision making process. The communication program on the shop floor was almost entirely informal. In fact, Company B did not make a general announcement to the shop floor employees when it won its environmental award.

2. A Significant Emotional Event. If there is one thing we wish we could bottle, it is the significant emotional environmental event. In both cases, the plant managers experienced such an event at another plant in their respective corporations and carried the scars from their experiences with them. For Company A, it was the inclusion of the plant site on the state Superfund list (on his first day on the job as plant manager, no less). For Company B, it was a significant production delay associated with a new air permit. For both managers, the desire to avoid cleanup or permitting hassles drove them to pursue pollution prevention.

3. Focus on Product Quality. Both companies maintain strong relationships with their customers and manufacture products tailored to meet a particular customer's needs. In both cases, the customer provided input directly to the production design staff at the manufacturing plant. The customers' environmental concerns included potential increases in production costs and disruptions in schedules associated with compliance problems at the manufacturing site.

4. Respect for the Environmental Manager. Dillon and Fischer (1992) reported that the location of the environmental manager's position in the organizational hierarchy was less important than the technical and interpersonal skills of the individual in the job. For both companies, the environmental manager's technical abilities were noted by several co-workers. They considered the environmental manager a "good person" as well as knowledgeable. Also, the environmental managers demonstrated a keen understanding of the need to put their companies' production and customer needs into the context of their environmental projects.

5. An Opportunity for Change. Company A used the opportunity to replace an old production line to incorporate the most efficient, environmentally sound, and cost-effective equipment on the market. The effort required input from the product designers, process designers, customers, financial officer, plant manager, environmental manager, production staff, vendors, and corporate staff and took nearly two years for approval. Company B's opportunity came in the form of advice from the university-based TAP and a clever vendor. The plant manager was struggling with escalating hazardous waste disposal costs and sought the advice of the vendor of the product in question. The environmental manager had just attended a free seminar offered by the TAP and created a project team consisting of the TAP, the vendor, and his experienced shop floor employees.

Why is Pollution Prevention So Hard to Do?

The decision making system in a mid-sized corporation involves many individuals and competitive organizational units. In the past, environmental issues were addressed by the environmental manager at the end of the production line. Effective pollution prevention, however, means moving up that line to find opportunities to reduce hazardous materials and other inefficiencies in the product and its production processes. Such changes require a more complex, integrated decision making structure that includes the customer, product and process designers, production staff, environmental and safety specialists, and others at both the facility and corporate levels.

The fundamental problem is organizational, not technological. In general, decision making is limited by the bounded rationality of the decision maker who operates within both formal (hierarchical) and informal (lateral) channels of communication in the organization. One problem with the more complex organizations found in mid-sized firms is the coordination of decisions which are separable into components where "the choice of an alternative can impose costs which are directly borne by other divisions or departments in the firm, and of which he [the decision maker] has imperfect knowledge" (Cremer, 1993). Deming (1993) illustrates this point quite well by showing how the components of a production flow diagram correspond to the typical organizational units in the company. The organizational units become competitive components of the system whose independent goals destroy the systemic functioning of the manufacturing plant. According to Deming, the role of management is to recognize and manage the interdependence between the organizational units, resolve conflicts, and remove barriers to cooperation.

TAPs for Pollution Prevention in Mid-Sized Firms

Our preliminary findings about the pollution prevention activities of mid-sized firms leads us to the following observations:

- Mid-sized firms present a considerable opportunity for reducing pollution and, because of their more complex organizational structure, pose a considerable challenge to traditional modes of technical assistance. Future activities on this project will focus on the economic and toxic chemical release activities of the firms in our initial study sample of 1,529 firms.

- Policies and programs designed to promote pollution prevention often neglect the relationship between the nature of the action and the capability of the organization to act. Decision making in mid-sized firms is multi-dimensional, but for pollution prevention at least two dimensions appear to be significant. TAPs for pollution prevention need components that address the systemic nature of both the technological problem and the decision making structure of the firm. The underlying reason is that the types of changes required to *prevent* pollution (product and process changes) are system-wide and require a comparable, system-wide decision making capacity.

Pollution prevention and business/management TAPs may want to reorganize (or combine) so that they can provide technologies (defined broadly) that: improve the organizational capacity of the company to characterize environmental problems systemically; and systemically reduce the environmental impact of its manufacturing practices. The technical assistance process could proceed as usual, with the environmental TAP intervening in the decision making process to solve a particular problem, and a concurrent evaluation of the decision making (management) capability of the firm by the business/management TAP.

In the end, the TAPs that work to enhance the capability of mid-sized and larger firms to solve their own problems (rather than solving the problems for them) can more effectively meet longer term social goals to improve environmental quality and economic competitiveness.

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