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BARRIERS TO WASTE REDUCTION EFFORTS: SMALL BUSINESS RESPONSE*

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ABSTRACT

Consultants and state agencies have emerged to provide information to companies wishing to manage their waste problems more effectively. One such agency, the Iowa Waste Reduction Center (IWRC), has provided assessments and technical assistance to Iowa businesses since 1988. The research reported here was undertaken because the IWRC wanted to determine the extent to which its waste management ideas were being implemented by their clients. The IWRC also wanted to know what prevented their clients from implementing various suggested measures. This survey research indicates that respondents were more likely to implement end-of-pipe waste recommendations than pollution prevention measures. Companies cited cost as the main reason for not carrying out proposed solutions. IWRC clients appeared more likely to be highly motivated by the perceived costs or potential threats than by the possible benefits of action. Policy implications for the IWRC and state lawmakers are drawn.

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Companies are spending ever more time and money on their waste disposal problems. As environmental regulation has become more stringent, companies are under increasing pressure to minimize waste streams. Consultants and state agencies have emerged to provide information to companies wishing to address their waste problems effectively. One such agency, the Iowa Waste Reduction Center (IWRC) at the University of Northern Iowa works primarily with small businesses. The Center provides assessments and technical assistance to Iowa businesses with fewer than 200 employees. The IWRC was established in 1987 under the Ground Water Protection Act of Iowa, and has been operating since January of 1988. The research reported here was undertaken because the IWRC wanted to determine how its waste management ideas were being implemented by its clients.

BACKGROUND

Many federal and state laws govern the handling and disposal of hazardous waste. Companies traditionally have responded to these regulatory pressures by applying end-of-pipe solutions. That is, companies generated the waste and only then looked for ways to treat it for discharge or disposal. As hazardous waste disposal costs increase, management must look for other ways to satisfy regulatory requirements. The Environmental Protection Agency (EPA), while still enforcing strict regulations, has been encouraging companies to prevent pollution rather than to control waste. That is, regulators are encouraging companies to alter production processes and inputs as a means of eliminating hazardous waste.

Companies face other pressures to eliminate hazardous waste problems. The risks and costs of non-compliance have risen along with the costs of compliance. Business insurance costs have increased and coverage for environmentally related liabilities has decreased. State and federal authorities can levy significant penalties if a company is found to be in violation of an environmental regulation. Businesses also need to be aware of community and employee health concerns related to their operations. Given these significant costs and pressures, there is a need to explain why a business would fail to implement a viable solution to their waste management problem.

POTENTIAL BARRIERS TO IMPLEMENTATION

There may be several reasons why a company elects not to implement a proposed solution. For example, companies do not possess unlimited economic resources. The suggested waste strategy may require more money or financing than a business can obtain. In addition, changing production inputs and processes may create costs of other kinds. Product quality may suffer with the substitution of less hazardous inputs. For example, the ability of printing and publishing

operations to reduce waste by substituting water-based inks for solvent-based inks is limited by the desired product quality.

Though tough legislation and stiff penalties may motivate businesses to eliminate hazardous waste problems, enforcement efforts seriously alter responses to the legislation. Some writers, such as Pratt and Schwartz [1], suggest that existing enforcement efforts may not be tough enough. These authors cite low inspection rates and poor inspection quality as two potential problems. Moreover, inspections often are not followed up with adequate enforcement; the prosecution rate has been low.

The lack of adequate measures of the costs and related benefits of pollution prevention programs present another barrier to full implementation of such programs. Firms may focus too much on the costs (new equipment needed, additional training costs) and not enough on the benefits (decreased liability, disposal cost savings). Other costs and benefits are less tangible and harder to measure, and so they are frequently omitted from consideration. Also, the benefits of reducing pollution levels may be minimal for small and conditionally exempt generators.

IOWA WASTE REDUCTION CENTER SURVEY

During the fall of 1994, the Center mailed questionnaires to a total of 200 former clients. Seventy-four questionnaires were returned shortly after the mailing. A follow-up questionnaire was sent to non-respondents, and another thirty-one questionnaires were returned for a total response count of 105 firms and a response rate of 52.5 percent. An analysis of the early and late respondents, using a Chi-square test, revealed no statistical differences in several characteristics. These characteristics included type of business, size of the workforce, and the amount of hazardous waste generated. A similar comparison of respondents and non-respondents revealed the absence of any non-response error.

As indicated in the previous section, two broad issues were addressed by the survey instrument: the extent of waste reduction efforts and barriers to such efforts. First, firms were asked to indicate whether they had implemented the specific waste reduction approaches recommended by the IWRC. Questionnaires were tailored to each firm so that only the specific recommendations applying to that firm were included in the survey. Second, firms that had not implemented particular waste reduction strategies were asked to identify the primary factor which limited their ability to do so. To get a broader picture of factors which motivate firms to control waste, all respondents (whether or not they had followed IWRC suggestions) were asked to indicate the extent to which they are influenced by factors such as the cost of waste reduction and competitive pressures to reduce waste. (The 8 motivating factors are discussed below.)

Other survey questions concerned the demographics of the surveyed companies and aspects of their waste reduction efforts. Firm size was measured by the

number of full-time employees and gross sales revenue. Respondents employed an average of seventy-six full-time employees with 35 percent of firms employing fewer than fifteen individuals, 36 percent employing between sixteen and forty-nine, and the remaining 29 percent of companies having more than fifty employees. Seventy-one of the 105 responding firms reported annual gross sales revenue; the average was $8.213 million (31% of the firms reported under $1 million, 38% fell in the $1 to $7 million dollar range, and 31% reported $7 million or more).

Firms were initially classified into twenty separate industries. These were subsequently collapsed to three categories depending on the type of waste problems encountered in the specific industries. Industry category 1 (33.3% of respondents) included autobody shops, auto dealers, farm implement dealers, marine dealers, auto parts dealers, and aircraft maintenance facilities. Category 2 (46.7%) included various types of manufacturing: metal and machinery, auto, farm and tools, fishing tackle, electronics, wood and building products, and coop feed and fertilizer dealers. Category 3 (20%) included printing and photography businesses, educational, government, research, and medical agencies, and grocery distributors.

Respondents also were categorized according to the amount of hazardous waste generated. Most fell into the two smallest classifications. Seventy-two percent were conditionally exempt small quantity generators with under 100 kg of waste generated per month. Twenty-six percent were small quantity generators (between 100 and 1000 kg/month). As only two firms were large quantity generators (more than 1000 kg/month), they were combined with the small quantity generators for convenience of analysis. Three percent of the firms reported having a full-time environmental specialist; 13 percent indicted having a part-time specialist.

EXTENT OF IMPLEMENTATION

IWRC made eighteen different types of recommendations for those firms. Table 1 summarizes the recommendations and gives the percent of recommendations that were implemented. Each firm received from one to five specific recommendations from this list.

We divide the recommendations into two broad categories: A (pollution prevention recommendations) and B (recommendations such as reuse of hazardous materials and reclamation and recycling suggestions). The lowest implementation percentages occurred with items 1 and 4 in category A and items 8 and 9 within category B. The other low implementation rates relate to less frequently made recommendations. On average, companies implemented 37.9 percent of pollution prevention (Category A) recommendations and 52.4 percent of the reuse/recycling (Category B) recommendations.

Table 1. Extent of Implementation

Recommendation	Number of Recommendations	Percent of Recommendations Implemented
A. Input, technology, and operating changes		
1. Use non-hazardous solvent	25	24.0
2. Replace aerosol cans with refillable canisters	7	14.3
3. Use polystyrene paint booth filters	9	55.6
4. Use hot soap parts washer	29	37.9
5. Eliminate floor dry	21	52.4
B. Use and/or reuse		
6. Extend solvent contract	19	68.4
7. Use a commercial laundry for oily rags and mops	14	50.0
8. Improve cutting fluid maintenance	7	42.9
Reclamation/recycling		
9. Purchase a solvent still	35	25.7
10. Recycle oil filters	29	48.3
11. Recycle antifreeze	20	60.0
12. Recycle oil	24	62.5
13. Recycle silver	5	60.0
14. Recycle woodwaste	5	60.0
15. Recycle cardboard	6	66.7
16. Recycle plastic	3	33.3
17. Recycle glass	1	100.0
18. Recycle paper	4	50.0

The information contained in Table 1 was analyzed to determine the percent of companies implementing recommendations within each broad category. Table 2 portrays the results. Again, the response of firms to recommendations involving changes in material, technology, and operating practices is poorer than for reclamation/recycling activities and use and reuse policies. The response to the recommendations varied (p = approximately 11%) between the two categories, according to a Chi-square test.

In order to help explain the difference in implementation rates, two variables were created to measure whether at least one recommendation within a category

Table 2. Percent of Firms Implementing Recommendations

Category	At Least 50% of the Recommendations Implemented	At Least One Recommendation Implemented	All Recommendations Implemented
Prevention	46.6	46.6	27.6
Reuse/Recycle	57.9	60.0	44.2

was implemented. These new variables (LeastA and LeastB) were assigned a value of one if at least one recommendation was implemented and zero if no recommendations were implemented. A comparison was made to determine whether the implementation within each category differed across certain firm characteristics (Table 3). The analysis reveals some differences, but none of them are statistically significant using a Chi-square test. Nonetheless, it is interesting to note the variations in the level of responses.

In general, the response to recommendations within the reuse/recycle category is higher than the response to the pollution prevention suggestions. Also, companies generating more waste appear slightly more likely to implement recommendations of any type (A or B). This finding may reflect the fact that the costs and potential risks are greater for these companies.

Smaller firms were somewhat more likely than larger ones to implement reuse/recycling recommendations. On the other hand, companies with a full or part-time environmental specialist appeared somewhat less likely to implement either type of recommendation. Generalizations should not be made, owing to statistical insignificance. In addition, implementation rates may reflect the specific nature of the recommendations, rather than any general feature of categories A or B *per se*.

BARRIERS TO IMPLEMENTATION

Companies not implementing the specific recommendations were asked to indicate the primary reason for their failure to do so. Companies had to indicate whether the cost of the program, a lack of information, quality concerns, a lack of time, or too little waste limited their ability to implement the specific recommendations given to them. Companies cited the lack of potential benefits (e.g., too little waste) more than any other single barrier. It should noted, however, that the remaining categories are similar in that they refer to some aspect of the cost of implementation.

The Center wanted to study whether barriers to implementation depended on the type of recommendation. For purposes of analysis, the first four factors were judged to represent cost barriers and the remaining option (too little waste) was

Table 3. Percent of Firms Implementing at Least One Recommendation by Firm Characteristics

Characteristic	Category A Prevention	Category B Reuse/Recycle
Full-time employees	($n = 55$)	($n = 90$)
Fewer than 25	48.5	66.7
25 and more	45.5	56.3
Sales revenue	($n = 38$)	($n = 64$)
Less than $3 million	47.4	56.3
$3 million and over	47.4	65.6
Waste generating category	($n = 56$)	($n = 93$)
Conditionally exempt	40.5	56.1
Small and large quantity	57.9	70.4
Environmental specialist	($n = 58$)	($n = 95$)
Yes	25.0	50.0
No	50.0	62.0
Chance of EPA inspection	($n = 42$)	($n = 64$)
Less than 50%	34.8	65.6
50% or greater	42.1	62.5

judged to represent a barrier related to potential benefits. When viewed this way, the cost concerns outweighed the concern with the potential benefits (Table 4).

The reuse/recycle recommendations (category B) were more sensitive to benefit concerns than the pollution prevention recommendations (Category A). This difference is statistically significant (Chi-square = 4.063, $p < .05$). These results are not unexpected. As noted, reuse and recycling may be cheaper and easier to implement while pollution prevention options are more costly in many ways.

MOTIVATING FACTORS

All respondents were asked to rate the influence of eight potentially motivating factors in the decision to institute waste reduction measures. Some of the factors were viewed as focusing on potential costs or threats (liability reduction, received inspection, employee health concerns, regulatory burden); the rest were

Table 4. Summary of Barriers to Implementation

	Category of Recommendation	
	A Prevention	B Reuse/Recycle
Percent of firms citing cost as primary concern	78.3	55.6
Percent of firms citing insufficient benefit (i.e., too little waste) as primary concern	21.7	44.4
Total	100.0	100.0

interpreted as involving potential benefits (cost reduction, competitive pressures, public relations, environmental concerns). IWRC clients were asked to indicate the level of influence of each factor (from "none" to "very great" on a 5-point scale). This scale was later collapsed to two levels of influence: "no to moderate" and "great to very great." The level of influence varied significantly across the motivating factors (Chi-square = 95.85, $p < .001$). This difference is perhaps most striking when the factors were categorized as relating to either costs or benefits. This analysis is summarized in Table 5. It is clear that IWRC clients were more likely to be very motivated by the perceived costs or potential threats than by the possible benefits (Chi-square = 10.23, $p < .01$).

The response to the individual potential motivators did not vary across the following demographic variables: the amount of hazardous waste generated, the use of an environmental specialist, the expected chance of inspection, and the method of charging environmental costs. Table 6 summarizes only the statistically significant relationships as measured with a Chi-square test.

Smaller companies (as measured by either employee size or sales) are more likely to respond to the perceived threat of an EPA inspection. They are not as likely to be motivated by potential cost reductions. The choice of capital budgeting techniques (net present value, payback or none) has an impact on the response to other potential benefits. That is, companies using less sophisticated or no capital budgeting techniques are more likely to give high ratings to potential public relations benefits and the intangible benefits of improving the environment. It is possible that companies using these less sophisticated methods rely more on the intuitive aspects of environmental action (or lack thereof) than on hard data from the capital budgeting techniques.

Table 5. Importance of Potential Motivating Factors

	No to Moderate Influence	Great to Very Great Influence
Percent of firms selecting cost factors as having . . .	42.1	57.9
Percent of firms selecting benefit factors as having . . .	55.4	44.6

Table 6. Response to Various Motivating Factors across Demographic Variables

Motivating Factor	Percent Rating Factor as Having Great to Very Great Influence	Chi-Square Value	*N*	*P*-Value
Received Inspection				
Employees < 25	58.6	5.45	63	.02
Employees > = 25	29.5			
Sales < 3 mil	57.1	4.41	47	.04
Sales > = 3 mil	26.9			
Cost Reductions				
Employees < 25	36.4	3.28	71	.07
Employees > = 25	57.9			
Public Relations				
Capital budget technique				
NPV	10.0	5.85	59	.05
Payback	50.0			
None	29.4			
Environmental Concerns				
Capital budget technique				
NPV	58.3	4.97	65	.08
Payback	88.2			
None	78.9			

DOES MOTIVATION TRANSLATE INTO ACTION

Based on this analysis, it is interesting to see how companies implementing at least one pollution prevention or control recommendation responded to the motivating factors. Table 7 shows the overall percentage of companies rating these factors as having potentially great to very great influence on decisions as well as the same ratings for companies which implemented at least one recommendation within either category.

When comparing companies in the LeastA and LeastB groups, a higher fraction of companies implementing a pollution prevention recommendation (LeastA) gave high ratings to seven of the eight potential motivating factors. A larger percent of the LeastA group rated six of these factors more highly than did the overall sample. That is, those companies implementing at least one pollution prevention recommendation were more likely to be strongly motivated by several of these factors than the full group of firms responding to the survey. The firms implementing at least one recommendation from the pollution reuse/recycle category were, as a group, less likely to be as motivated by the eight factors than the overall sample.

Table 7 also shows the differences in the responses to the potential cost factors (the first 4 items) versus the potential benefit factors (the last 4). The cost factors were rated as having greater influence on implementation decisions by more firms than were the potential benefit factors. This result is consistent with Table 5. Interestingly, companies focus on costs as both motivating factors and as significant barriers to implementation. The costs associated with implementing and/or not implementing a variety of waste management solutions are foremost in the minds of the IWRC's small business clients.

Table 7. Percentage of Companies Rating Factors as Having High Degree of Influence

Motivating Factor	Overall Percent	LeastA (Prevention)	LeastB (Reuse/Recycle)
Liability reduction	63.1	70.8	61.7
Received inspection	41.5	55.0	34.1
Employee health concerns	67.6	79.2	64.4
Regulatory burden	56.9	60.9	56.5
Cost reduction	47.3	43.5	38.8
Competitive pressure	10.3	4.5	9.3
Public relations	35.1	39.1	31.9
Environmental concerns	80.0	87.5	76.0

IMPLICATIONS OF IWRC STUDY

Overall, implementation of proposed solutions is rather low among IWRC clients. The IWRC clients do not perceive the potential benefits to be great enough to warrant action. It may be that they do not fully understand the tangible and intangible costs and benefits of pollution prevention and reuse/recycle activities.

Some insight into this issue is provided by an analysis of the responses to questions regarding the accounting treatment of environmental expenses and the techniques for capital budgeting used by these firms. Most of the businesses that responded to the survey use fairly unsophisticated capital budgeting methods (50% use payback analysis, 30% apparently use no formal method). Half of the respondents reported charging environmental expenses directly to overhead, as opposed to departments or jobs. Given the size of many of these businesses, such responses are not surprising. However, it is possible that their accounting and capital budgeting practices represent another barrier to implementing pollution prevention and control solutions. That is, these small business owners may not be basing their implementation decisions on a comprehensive set of data. IWRC clients do not have means available for measuring the costs of complying with waste disposal requirements; nor are they likely to be fully considering the costs of continuing potentially substandard disposal practices, such as costs associated with penalties and liabilities for noncompliance. Without a full measure of these and other costs, the potential benefits will not be evident to the firms.

IWRC might further educate its clientele about the costs and benefits of any recommendations by incorporating detailed cost and benefit information (including the costs associated with no action) into the formal report submitted to each company. The IWRC also might consider holding workshops to help businesses assimilate this more complete information into a variety of models.

The results of this survey might lead regulators to conclude that enforcement efforts directed toward small businesses need to be strengthened. Stronger enforcement is likely to promote short-term action on the part of the businesses. That is, businesses will continue to respond to regulatory threats by implementing the obvious reuse and recycling solutions.

Instead of redoubling enforcement in traditional ways, regulatory efforts directed at small businesses may need to be reformulated. Specifically, the push toward pollution prevention, rather than control, may need to be extended to small business. State regulators and the EPA have achieved some success in their pollution prevention campaigns directed to the large quantity generators. Voluntary initiatives such as EPA's 33/50 and Green Lights Programs have met with some success. There also has been some experimentation with market incentives such as tax breaks and emission taxes. These types of solutions may be effective with smaller businesses.

There is surely room for creative approaches to the high cost of preventing, reducing and treating small business waste. The collaborative efforts of the public and private sectors are useful instruments for developing such approaches.

REFERENCE

1. W. Pratt and S. Schwartz, *Hazardous Waste from Small Quantity Generators*, Island Press, Washington, 1990.

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