The Cost of Developing Site-Specific Environmental Regulations: Evidence from EPA's Project XL

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Abstract

The flagship of the Environmental Protection Agency's regulatory reinvention initiative, Project XL has been touted as a 'regulatory blueprint' for a site-specific, performance-based pollution control system. But widespread complaints about the costs of the program beg the question of whether the costs of tailoring regulations to individual facilities are manageable. To address this question, this paper presents original survey data on a sample of 11 XL projects. We find that the fixed costs of putting in place XL agreements are substantial, averaging over $450,000 per firm. While stakeholder negotiations are widely cited as the principal source for these costs, we find that they actually arise mainly from interaction between participating facilities and the EPA. Moreover, EPA management problems are perceived by our survey respondents as having inflated project development costs. Finally, we find that the key factor that explains differences in costs across XL projects is the scope and complexity of the project proposal. These findings suggest that Project XL favors large firms that can afford to pay significant project development costs, that EPA management problems must be resolved to reduce costs, and that there may be a significant economic bias against complex and innovative proposals—precisely the type of proposals that Project XL was designed to foster in order to improve the efficiency of the regulatory system.

Key Words: Project XL, site-specific regulation, tailored regulation, voluntary regulation, transactions costs, regulatory reform and reinvention

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The Cost of Developing Site-Specific Environmental Regulations: Evidence from EPA's Project XL

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Launched with considerable fanfare in March 1995, Project XL (which stands for eXcellence and Leadership) is the flagship of the Environmental Protection Agency's regulatory reinvention initiative. Project XL is premised on the idea that the existing command and control regulatory system stifles efficiency and innovation by dictating "one size fits all" abatement strategies rather than letting individual facilities decide how to control pollution. Facilities that participate in Project XL are allowed to develop pollution control strategies that "replace or modify specific regulatory requirements" on the condition that these strategies improve their environmental performance (60 FR 27282). In essence, Project XL defines site-specific performance standards that are more stringent than the *de facto* standards implied by current regulation, and allows facilities some flexibility in meeting them.

Project XL has frequently been described as a prototype for a new site-specific approach to environmental regulation. President Clinton has called it a "regulatory blueprint for the future," a characterization that has been reflected to varying degrees in the popular press and in the policy literature (Phillips, 1995; Cushman, 1996; NAPA, 1997; Hauseker, 1999). Yet by virtually all accounts, Project XL has fallen short of early expectations. After five years, only 15 facilities are implementing XL agreements.

Whether Project XL eventually emerges as prototype for a new regulatory regime or just an abortive experiment, it provides an unparalleled opportunity to evaluate the barriers to site-specific performance-based regulation. The academic literature analyzing the project has focused almost exclusively on institutional and legal barriers (e.g., Susskind and others, 1997; Cabellero, 1998). Partly because there has been little data available, an equally important barrier has received far less attention in the literature: the costs to firms, regulators and other stakeholders of tailoring regulations to individual facilities. Such costs are sometimes referred to as "project development costs" or "transactions costs" to emphasize they arise from putting site-specific regulations in place rather than complying with them after they have been established. If these costs are significant—as intuition would suggest—at least two troubling implications for site-specific regulation follow. First, given the sheer number of polluters in the United States, implementation on a broad scale would be neither practical nor efficient. And second, a site-specific regime would favor firms that, for whatever reason, find it either less costly or more beneficial to participate.

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Thus, realizing the benefits of site-specific regulation will depend on controlling project development costs. Towards this end, this paper presents both original survey data and publicly available data on a sample of 11 XL projects. We address three related research questions:

- What is magnitude of project development costs?
- What stages of the project development process and what issues associated with that process are perceived as being the most costly?
- Why is the project development process more costly for some facilities? In particular, what role do characteristics of the project proposal, the facility, the firm, and the negotiation process play in determining the magnitude of project development costs?

To our knowledge, this paper represents the first in-depth effort to address these issues. The remainder of the paper is organized as follows. The first section provides further background on Project XL. The second section develops an informal conceptual framework to underpin the empirical analysis. The third section briefly discusses our data and sample. The fourth section outlines our methodology. The fifth section presents our empirical results. The last section sums up and concludes.

1. Background

1.1. The project development process

This section describes the regulatory process that gives rise to project development costs (US EPA, 1999a). First, applicants draft project proposals and submit them to EPA. In theory, they do this in cooperation with EPA regional offices—the EPA divisions that are primarily responsible for individual XL projects—as well as with state regulators and other local stakeholders. Next, a team of EPA and local regulators reviews the proposal, requests any additional information or revisions deemed necessary, and makes a recommendation as to whether the project should go forward. Proposals are judged by eight criteria:

- Environmental results: the project should “achieve environmental performance that is superior to what would be achieved through compliance with current and reasonably anticipated future regulations.”
- Cost savings and paperwork reduction.
- Stakeholder support: sponsors are responsible for seeking and enlisting the support of stakeholders including communities near the project, local and state governments, businesses, and environmental advocates.
- Innovation/multi-media pollution prevention.
- Transferability: projects should test new approaches that could one day be applied more broadly.
- Technical and administrative feasibility.

- Monitoring reporting and evaluation: sponsors should make information about the project and project performance available and understandable and define clear measurable objectives.
- Avoid shifting the risk burden: the project must protect worker safety and ensure that “no one is subjected to unjust or disproportionate environmental impacts.”

If proposals meet these criteria, the applicant, regulators, and direct participating stakeholders negotiate a Final Project Agreement (FPA) that defines the innovation to be tested, the required level of environmental performance, the regulatory flexibility that will be granted, what conditions must be met, and how the results will be monitored. The last step in the project development process is obtaining final approval from EPA headquarters.

1.2. Literature and history

Virtually since its inception, Project XL has been plagued by the perception that the project development process is too costly. As early as the summer of 1996, a little over a year after the program was unveiled, participating firms complained that poor coordination among federal, regional, and local regulators and a lack of clarity in project guidelines—particularly those concerning superior environmental performance and the stakeholder process—were driving up project development costs (Environmental Reporter, 1996; Inside EPA, 1996a).

Written analysis of Project XL has consistently mirrored these early industry complaints. For example, Steinzor (1996) argues that Project XL was pushed forward without clear guidelines for political reasons. Yosie and Herbst (1996) present survey data reflecting frustration among XL participants over the length and cost of EPA’s review process and conflicts between EPA regional offices and headquarters. The General Accounting Office (US GAO, 1997) contends that Project XL is hampered by poor coordination with other reinvention initiatives, consensus-based stakeholder decision-making, weak evaluation, and a failure to secure buy-in by Agency staff. Finally, Mank (1998) argues that Project XL has been stymied by flaws in program design and by legal uncertainty about EPA’s authority to develop site-specific regulations.

Over the last five years, the EPA has undertaken a wide range of measures designed to address these criticisms. At the end of 1996, it appointed ombudsmen in EPA regional offices to resolve problems causing delays in proposal development (Inside EPA, 1996b). At the beginning of the next year, it published a “mid-course correction” in the Federal Register clarifying guidelines regarding superior environmental performance, regulatory flexibility and the stakeholder process (60 FR 19872). In 1998, the EPA published a second Federal Register notice soliciting proposals on selected themes, and further clarifying the concept of regulatory flexibility (60 FR 34161). It also released two reports evaluating specific XL experiences (US EPA, 1998a, 1998b). In 1999, the EPA issued three guidance documents that grew out of an effort to redesign and streamline the XL approval process as well as a comprehensive evaluation of 14 projects in implementation (64 FR, 16450, Inside EPA, 1997, US EPA, 1999b).

Despite these efforts to reform the project approval process, EPA has not been very successful in moving proposals though the approval process. As noted above, as of December 1999, only 15 XL projects had been approved. In part, this was due to a drastic drop off in the number of proposals received by the EPA after the first year of the program. Between 1996 and 1998, only 14 preliminary proposals were accepted for project development (US EPA, 1999a).

2. Framework for analysis

Figure 1 summarizes an informal conceptual framework intended to underpin our empirical analysis of the determinants of project development costs. We break down the project development process described in Section 1.1 into four stages: initial proposal development, stakeholder negotiations, FPA development (essentially, interaction with the EPA regional office), and final approval. Costs may be generated in each stage. As the arrows in the diagrams illustrate, the outcomes from each of these stages can affect costs in the other stages. For example, a particularly complex proposal may raise the costs of stakeholder negotiations, FPA development and final approval. Likewise, a consensus-based stakeholder negotiation process may raise the costs of FPA development, final approval, and proposal development.

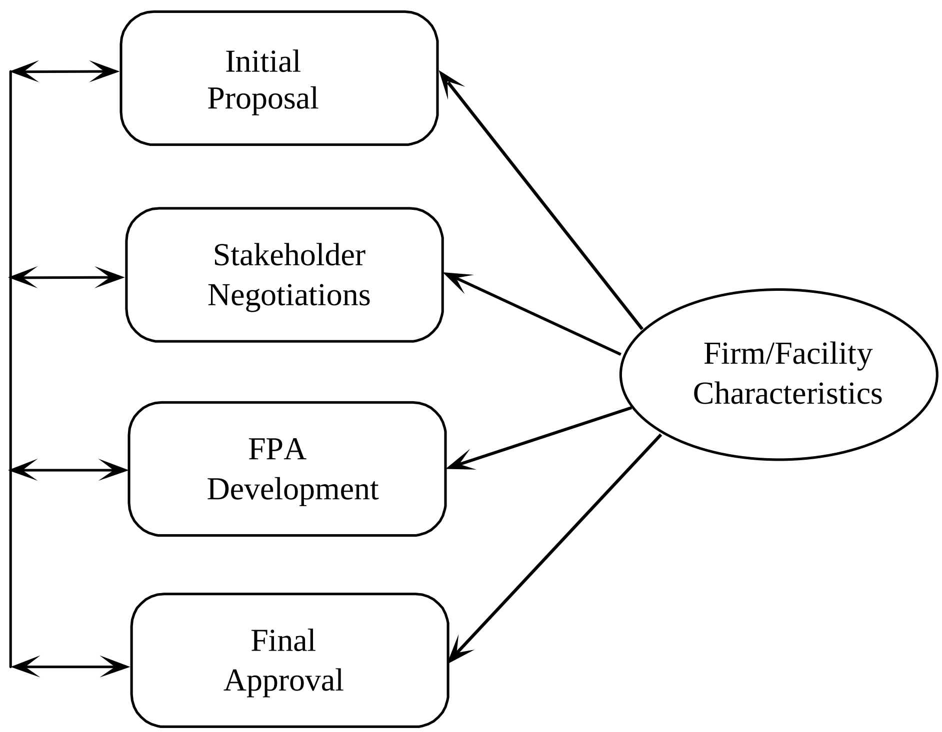

Figure 1. Determinants of project development costs

Two sets of factors that are ‘exogenous’—that is, unaffected in the short run by any other determinants of costs—can also have an impact on costs. One is the characteristics of the firm and of the facility submitting the proposal. For example, the location of a facility near an environmentally sensitive area may raise the costs of stakeholder negotiation and final approval stages. A second (omitted from Figure 1 for the sake of simplicity) is the rules and institutions that govern each stage of the process. For example, unclear guidelines regarding the stakeholder negotiation process may raise costs both in this stage and in other stages.

It is important to note that each of the factors pictured in Figure 1 are interdependent and therefore can have a ‘direct’ impact on costs and an ‘indirect’ impact. For example, firm characteristics can affect costs incurred in the final approval stage directly and also indirectly through proposal development. More specifically, large firms may incur relatively high costs in the stakeholder negotiation stage because they are highly visible and attract the attention of national environmental advocates (a direct effect) and may also tend to submit relatively complex proposals that raise costs in every stage of the project development process (an indirect effect). As we shall see, the distinction between direct and indirect effects turns out to be critical in interpreting our results.

Our empirical analysis focuses on a subset of the universe of potential determinants of costs: the characteristics of participating firms and facilities (the oval in Figure 1), and the characteristics of project proposals and the stakeholder negotiation processes (the top two rounded rectangles). We forgo a detailed analysis of the impact of rules and institutions because this has been the principal focus of the literature on Project XL to date and the benefit of further analysis would be limited. For similar reasons, we have devoted little attention to the FPA development and approval stages.

3. Data and sample selection

Our sample includes 11 firms: eight whose FPAs are being implemented (Intel, Hadco, Berry, Merck, Weyerhaeuser, OSi-Witco, Lucent and Molex), one whose proposal is in the project development phase (Imation), one whose proposal has been withdrawn (3M), and one whose project was facilitated with the help of Project XL (IBM’s proposal requesting permission to use an alternative wastewater treatment process resulted in a decision by EPA to issue a ‘determination of equivalent treatment ruling’ that made the XL project redundant). We used two criteria to select our sample. First, we included only firms whose proposals were submitted in the first six months of the Project because these were the only firms that had completed the process at the time we administered our survey. In addition, this criteria allowed us to control for subsequent changes in Project guidelines and administration (described in Section 1.2). Second, we only included private-sector participants because they are the primary target of Project XL and also because one would expect the nature and sources of costs to be different for public-sector participants.

For each firm in our sample, we administered two confidential surveys in the Fall of 1998: one to a representative of each firm and a second to a representative of each EPA regional office involved in developing the project agreement. The surveys were sent out by mail and the responses were collected by telephone interview. Our secondary sources of data are detailed in the Appendix.

4. Methodology

To address our first research question (what is magnitude of project development costs?) we present summary statistics of self-reported cost data for each of our survey respondents. Costs include the monetized value of legal fees and person hours spent on the four project development activities described in the preceding section. They do not include the costs of capital investments associated with XL agreements. Note that in considering the total costs of project development, we are theoretically interested in costs to all stakeholders: participating firms, EPA regional offices, EPA headquarters, local regulators and other stakeholders involved in the negotiation process. However, collecting data on all of these costs would have been prohibitively expensive. As a proxy for total costs to all parties, we collected two types of cost data for each project in our sample: monetized total costs to each participating facility reported by the facility and monetized total costs to the relevant EPA regional office reported by a EPA staffer involved in the project. We believe that this proxy for total costs is reasonable because in most cases, the sum of the costs incurred by the firms and EPA regional offices probably represents the bulk of the total costs to all parties and, in any case, it is likely to be proportional to the total costs incurred by all parties. Note that because our proxy does not include costs to all parties, it almost certainly underestimates total costs. In addition to monetized costs, we also report the duration in months of development process for each project.

To address our second research question (what stages of the project development process and what issues associated with that process are perceived as being most costly?) we report survey respondent's estimates of the percentages of costs attributable to each stage of the project development process as well as their rankings of a set of issues that the literature identifies as likely to have been important determinants of costs.

The means by which we address our third research question (why is the project development process more costly for some facilities?) is somewhat more complicated. We are unable to use multivariate regression to determine which characteristics of the project proposal, the facility, the firm, and the negotiation process are correlated with monetary costs because, with just 11 observations and over 20 explanatory variables, we simply do not have enough data. Therefore, we employ a simpler second-best approach. First, we classify each project as either "high-cost" or "low-cost" depending on whether total costs—the sum of costs incurred by firms and by EPA regional offices—is above or below the median for the sample (Table 2). We use the median rather than the mean to control for outliers. Next, for each of the explanatory variables, we calculate means for the high-cost sub-sample and for the low-cost sub-sample and we use a t-test to determine whether there is a statistically significant difference between the two (Medenhall and Schaeffer, 1973, 346). We interpret significantly different means to indicate that there may be a direct or indirect causal relationship between the explanatory variable and cost. Table 1 lists the variables used to differentiate between high- and low-cost projects. Precise definitions of each variable as well as data sources are provided in the Appendix.

In interpreting the results from this simple procedure, it is important to bear in mind that we are not able to control for correlations between the explanatory variables. For example, say that we find correlations between public ownership and costs and between firm size and costs. Further, say we know that these two explanatory variables are correlated—large firms tend to be publicly owned. Our methodology does not allow us to determine whether there is a causal relationship between public ownership and costs, or just a correlation between public ownership and firm size.

Table 1. Variables used to differentiate between high- and low-cost projects

Variable	*Comment*
Proposal characteristics	
Principal flexibility requested	E.g., emissions cap, de-listing of haz. material
Multiple facilities (y/n)	Does the agreement cover more than one facility?
Principal media affected by flexibility	E.g., air, water, hazardous waste, solid waste
Legal lever	Legal mechanism used to grant flexibility
Firm characteristics	
Rapid innovator (y/n)	A proxy for benefits of permit pre-approval
Number of employees	A measure of firm size
Among top 3 firms in mkt. share (y/n)	A measure of market leadership
Pollution intensity	Sector pollution control expenditures per $ output
Publicly traded (y/n)	Is management accountable to shareholders?
Market share largest 8 firms	A measure of industry concentration
Facility characteristics	
Other vol. federal reg. agrmts. (y/n)	E.g., CSI, Design for Environment, etc.
Non-compliance history (y/n)	Has facility been fined or cited by EPA?
Number of employees (y/n)	A measure of facility size
County personal income (y/n)	A proxy for community pressure on polluters
Percent county employment	Share of total county labor force employed
EHS staff size	A measure of human resources
Miles to nearest town	A measure of perceived risk of reg. flexibility
Adjacent residential areas (y/n)	A measure of perceived risk of reg. flexibility
Adjacent to env. sens. areas (y/n)	A measure of perceived risk of reg. flexibility
Stakeholder process characteristics	
Professional facilitator (y/n)	Used to conduct stakeholder meetings
Consensus decision rule (y/n)	Was unanimous consent needed for approval?
Number of stakeholders	Of all types directly involved in negotiations
Pre-existing com. adv. panel (y/n)	Did facility have a panel prior to XL proposal?

5. Results

5.1. What is the magnitude of project development costs?

Table 2 illustrates that total costs were quite substantial. For firms, the average cost of project development was $347,511. For EPA regional offices, the average cost was $111,163. The average total cost was $458,674. The average duration of the project development process was 26 months.

Table 2. Costs of developing XL project agreements

Firm	*Firm cost[a] ($) above median?*	*EPA cost[a] ($) above median?*	*Total cost[a] ($) above median?*	*Duration[b] (months)*	*Duration[c] above median?*
High-cost					
Imation	no	yes	median	41[d]	yes
Intel	yes	no	yes	17	no
Lucent	yes	yes	yes	33	yes
Merck	yes	yes	yes	26	yes
Weyerhaeuser	yes	yes	yes	16	no
3M	yes	yes	yes	wthdrn 9/96	n/a
Avg. high-cost	$516,187	$170,150	$686,337	27	
Low-cost					
Berry	no	no	no	12	no
Hadco	no	median	no	27	yes
IBM	no	no	no	18	no
Molex	no	no	no	37	yes
Osi-Witco	median	no	no	25	median
Avg. low-cost	$145,100	$40,378	$185,478	24	
Average All	$347,511	$111,163	$458,674	26	
Median All	$325,000	$107,168	$540,136	26	

Notes: [a] firm-specific cost data omitted to preserve confidentiality; [b] as of March 1998; [c] for approved FPA only [d] ongoing. *Source:* RFF survey, 1998.

5.2. What stages of the project development process are most costly?

Table 3 presents averages of firms' estimates of the percentages of costs attributed to each of five stages of the project development process (these are the same as the stages depicted in Figure 1, except that the "FPA development" stage has been broken down into two sub-stages). On average, roughly a quarter of total costs arose from interacting with EPA regional offices and a quarter from obtaining final approval from EPA headquarters. About one fifth of total costs arose from negotiating with stakeholders. Less than one fifth arose from interacting with local regulators and from developing a preliminary proposal. Thus, our results confirm the conventional wisdom that interacting with EPA has been the most costly element of the project development process. Although stakeholder negotiations have received considerable attention in the literature, our results indicate that they are a secondary source of costs for most firms.

Table 3. Average percentages of firms' costs associated with each project development stage

Stage	*All firms (n = 11)*	*High-cost firms (n = 6)*	*Low-cost firms (n = 5)*	*t-statistic*
Preliminary proposal	18.6	5.0	35.0	(-4.187)**
Stakeholder negotiations	20.2	16.2	25.0	(-1.291)
Interact w/ local regulators	13.4	17.0	9.0	(2.619)*
Interact w/ EPA region	22.5	24.5	20.0	(0.904)
Final approval	24.4	37.5	8.6	(6.714)**
Other	1.1	0.0	2.4	(-3.537)**

Notes: *Difference between high- and low-cost firms significant at 5 percent level. **Difference between high- and low-cost firms significant at 1 percent level. *Source:* RFF survey 1998.

The average percentage of costs attributed to developing a preliminary proposal was significantly higher for firms with low-cost projects (for convenience we will refer to such firms as "low cost firms" and those with high-cost projects as "high-cost firms"). This suggests that carefully developing a preliminary proposal may reduce costs in subsequent stages of the project development process. In addition, the average percentages of costs attributed to interacting with local regulators and to obtaining final approval were significantly higher for high-cost firms, suggesting that these two stages were the bottleneck in the project development process for high-cost firms.

Table 4 presents averages of estimates of the costs attributed by EPA regional offices to each stage of the project development process. Interacting with firms accounted for roughly one third of total costs, interacting with EPA headquarters to obtain final approval accounted for roughly one quarter of total costs, and the remaining stages—including stakeholder negotiations—accounted for less than one fifth of total costs each. Compared with firms, EPA survey respondents attributed a higher fraction of total costs to interactions between the firms and EPA regional offices, and a lower fraction to stakeholder negotiations. This is not surprising since firms, not EPA regional offices, were responsible for setting up and conducting stakeholder negotiations.

As would be expected, the average percentage of costs attributed by EPA regional offices to stakeholder negotiations was significantly higher for high-cost firms. Surprisingly, the average percentage of costs attributed to interacting with local regulators was significantly lower for high-cost firms. Note, however, that this does not necessarily imply that the *absolute* cost of interacting with local regulators was lower for high-cost firms.

Table 4. Average percentages of EPA regions' costs associated with each project development stage

Stage	*All firms (n = 11)*	*High-cost firms (n = 6)*[a]	*Low-cost firms (n = 5)*	*t-statistic*
Preliminary proposal	10.2	4.0	15.3	(-1.899)
Stakeholder negotiations	8.6	14.0	4.2	(3.615)**
Interact w/ local regulators	18.7	11.0	25.2	(-3.616)**
Interact w/ firm	34.2	39.0	30.2	(1.266)
Final approval	26.5	29.0	24.5	(0.540)
Other	1.6	3.0	0.5	(1.832)

Notes: [a] Two EPA regional offices were involved in Hadco process, the EPA regional office involved in Lucent process did not respond to this question. **Difference between high- and low-cost firms significant at 1 percent level. *Source:* RFF survey 1998.

5.3. What issues associated with project development are most costly?

Our survey asked respondents to choose what they perceived to be the first most important and second most important sources of costs from a list of ten issues frequently mentioned in the literature (Table 5). To develop an overall ranking of these issues based on our survey data, we counted the number of times each was chosen as 'most important' or 'second most important.'

For firm respondents, issue D, "lack of coordination among EPA offices," is first, having been chosen as 'most important' or 'second most important' six times. Issue A, "requirement of superior environmental performance unclear," is second, having been chosen five times. There is no correlation between the issues firms chose as most important and their ranking as either high-cost or low-cost.

For EPA respondents, two issues are tied for first: issue D, "lack of coordination among EPA offices," and issue J, "other program design issues" were each chosen five times. Two issues are also tied for second: issue A, "requirement of superior environmental performance unclear," and issue C, "EPA lacks clear statutory authority to implement projects" were each chosen four times. As with firms, there is no correlation between the issues EPA regional offices chose as most important and their ranking as either high-cost or low-cost.

Thus, taken together, our firm and EPA survey results suggest that among the cost-related issues identified in the literature, lack of coordination among EPA offices and lack of clarity about the requirement of superior environmental performance were seen as most responsible for driving up project development costs. But this finding does not explain why these costs were high for some firms but not for others: these two issues were seen as the most important sources of costs by all our survey respondents regardless of whether their projects were high- or low-cost. Moreover, our survey respondents' perceptions about the remaining issues in the above list were not correlated with costs. Thus, to explain differences in costs across firms we need to look elsewhere.

Table 5. Importance to firms and EPA regions of 10 sources of project development costs

Source of costs	*No. times selected 1st or 2nd most important by…* Firms	*EPA regions*[a]
A. "Superior environmental performance" requirement unclear	5	4
B. Design stakeholder negotiating process flawed	1	0
C. EPA lacks statutory authority to implement FPAs	2	4
D. Lack of coordination among EPA offices	6	5
E. Lack of coordination between state and local regulators	0	1
F. Lack of coordination between EPA and other regulators	3	2
G. Lack of coordination with other EPA regulatory reform initiatives	0	0
H. Industry competitors blocked FPA approval	0	1
I. National environmental advocates blocked FPA approval	1	2
J. Other program design issues	4	5

Note: [a] Two EPA regional offices were involved in Hadco process. *Source:* RFF survey, 1998.

5.4. Why is the project development process more costly for some firms?

The next two sub-sections discuss tests for correlations between the explanatory variables listed in Table 1 and project development costs. We will argue that of all of the explanatory variables, the complexity of the project proposal best explains differences in project development costs across projects.

5.4.1. Characteristics of the project proposal, firm, facility, and stakeholder process

Table 6 clearly illustrates that certain characteristics of the project proposal are correlated with high project development costs. Every one of the proposals in the high-cost category entails either: (i) caps on multiple air pollutants and permit pre-approval (Imation, Intel, Merck, Weyerhaeuser, 3M), and/or (ii) multiple facilities (Lucent, 3M). None of the low-cost proposals entail a cap on emissions and only one (Hadco) entails multiple facilities. In fact, most of the low-cost proposals concern relatively simple regulatory flexibilities, mostly having to do with waiving specific hazardous waste treatment requirements. This correlation between the complexity of the proposal and the cost of shepherding it through the approval process is not surprising. Proposals requesting caps on multiple air pollutants require regulators to confront difficult new issues (such as how to set the caps, whether to allow cross pollutant trading, how often to require repermitting, and how to monitor compliance) and proposals covering multiple plants clearly require more evaluation and negotiation than those covering a single plant. The legal lever used to grant flexibility to the facility is not significantly correlated with project development costs.

Table 6. Proposal characteristics by cost category

Firm	*Principal flexibility requested*	*Multiple facilities?*	*Principal media affected by flexibility*	*Legal lever*
High-cost				
Imation	caps 4 C.A.P.s + other A.P.s; permit preapproval	no	air	under development
Intel	caps 5 C.A.P.s + H.A.P.s; permit preapproval	no	air	alternative permits
Lucent	permit preapproval	yes	air, water, s. & h. wastes	site-specific rule
Merck	aggregate cap 5 C.A.P.s; caps 3 C.A.P.s; permit preapproval	no	air	site-specific rule; permit variance
Weyerhaeuser	cap on H.A.P.s & water effluents; consolidated reporting; waiver review	no	air, water	existing waiver mechanism
3M	caps on 5 C.A.P.s + H.A.P.s; permit preapproval	yes	air	wanted site-specific rule
Low-cost				
Berry	consolidated permitting	no	air, water, s. & h. waste	generally applied int. statements
Hadco	delist wastewater sludge	yes	water, s. waste	existing waiver mechanism
IBM	alternative wastewater treatment	no	water	determination of equivalent treatment
Molex	delist wastewater sludge	no	water, s. waste	existing waiver mechanism
Osi-Witco	deferral of new technology standards for h. waste	no	air, water	existing waiver mechanism

Abbreviations: A.P. = air pollutant; C.A.P. = criteria air pollutant; H.A.P. = hazardous air pollutant; V.O.C. = volatile organic compound. *Sources:* see Appendix.

Four of the six firm characteristics that we consider—rapid innovator, number of employees, top market share, and market share of the largest eight firms in the industry—are significantly correlated with project development costs (Table 7). A rapid innovator is a firm that continuously introduces new products and therefore constantly changes its production process. Each of the five rapid innovators in our sample is in the high-cost category. The reason is almost certainly that each of these five firms submitted proposals requesting caps on multiple air pollutants and permit pre-approval. They very likely did so because as rapid innovators, they incurred extremely high 'hold-up costs' due to Clean Air Act Amendments (CAAA) Title V requirements to re-permit every time their production process changed. Rapid innovators have complained for some time about the hold-up costs associated with these requirements (The Reinvention Report, 1999a)

Table 7. Firm, facility, and stakeholder process characteristics by cost category

Characteristic	*All firms*	*High-cost firms*	*Low-cost firms*	*t-statistic*
Firm characteristics	*(n = 11)*	*(n = 6)*	*(n = 5)*	
Percent rapid innovator	45.5	83.3	0.0	(10.113)**
Average number of employees[a]	43,445.4	62,123.2	6,090.0	(4.935)**
Percent in top 3 market share	81.8	100.0	60.0	(3.618)**
Average pollution intensity	1.10	1.04	1.20	(-0.369)
Percent publicly traded	90.9	100.0	80.0	(2.216)
Average market share largest 8 cos.	54.9	61.8	46.6	(4.929)**
Facility characteristics	*(n = 13)*	*(n = 6)*	*(n = 7)[b]*	
Percent w/ voluntary fed. reg. agrmts.	0.615	0.667	0.571	(0.764)
Percent w/ non-compliance history[c]	27.3	33.3	20.0	(0.967)
Average number of employees[d]	894.6	1,148.0	683.3	(2.705)*
Percent w/ certified EMS system	15.4	33.3	0.0	(3.848)**
Average county personal income[e]	19,326.8	19,258.8	19,394.8	(-0.179)
Percent county employment[f]	6.9	4.3	8.8	(-2.797)*
Average EHS staff size[g]	10.3	10.6	10.0	(-0.276)
Average miles to nearest town[c]	1.7	2.0	1.4	(0.940)
Percent adjacent residential areas	46.2	50.0	42.9	(0.556)
Percent adjacent to env. sens. areas	38.5	66.7	14.3	(4.880)**
Stakeholder process characteristics	*(n = 11)*	*(n = 6)*	*(n = 5)*	
Percent w/ professional facilitator	27.3	50.0	0.0	(4.523)**
Perc. w/ consensus decision rule	15.0	33.3	0.0	(3.198)**
Average number of stakeholders	11.2	12.2	10.0	(1.706)
Perc. w/ pre-exsting com. adv. panel[h]	30.0	60.0	0.0	(4.899)**

Notes: [a]Excludes IBM as outlier (269,465 employees). [b]Includes 3 Hadco facilities. [c]Data not available for 2 of 3 Hadco facilities. [d]Excludes IBM as outlier (8,000 employees), data not available for Lucent. [e]Data not available for 1 of 3 Hadco facilities. [f]Data not available for Lucent. [g]Excludes IBM and 3M as outliers; data not available for Lucent. [h]Data missing for Intel. *Difference between high- and low-cost firms significant at 5 percent level. **Difference between high- and low-cost firms significant at 1 percent level. *Sources:* see Appendix.

Table 7 also illustrates that while XL participants in general tend to be large industry leaders operating in sectors where the top eight firms control the lion's share of the market, *particularly* large firms, those in the top three in terms of market share, and those that operate in *particularly* concentrated markets incurred relatively high project development costs.

Four of the ten facility characteristics that we consider—number of employees, certified environmental management system, percentage of county income employed, and proximity to an environmentally sensitive area—are correlated with project development costs (Table 7). Facilities with more employees, those with a certified EMS system in place, and those located in close proximity to officially designated environmentally sensitive areas incurred higher project development costs. Surprisingly, percentage of total county employment contributed by each facility—intended as a proxy for the local political influence of the facility—is correlated with *lower* project development costs.

Three of the four explanatory variables that concern the stakeholder negotiation process are correlated with transaction costs (Table 7). Employing a professional facilitator, relying on a consensus-based decision rules, and using a pre-existing community advisory panel were all positively correlated with project development costs. However, in interpreting these results it is important to bear in mind that, as discussed in Section 5.2, neither firms nor EPA regional offices perceived the stakeholder negotiation process to be a major component of project development costs. Thus, there is little basis for the hypothesis that differences in stakeholder negotiation determine the overall cost of project development.

5.4.2. Which explanatory variables really drove costs?

We found that 12 characteristics of the project proposal, firm, facility, and stakeholder process were correlated with the cost of the project development process. Given that, as explained in Section 4, our sample is too small to support the use of statistical techniques that would better indicate which these 12 correlations are really driving costs, we are forced to rely on intuition. In our opinion, the following explanation is the most convincing, although it is certainly not the only possible explanation.

The complexity of the project proposal drove differences in project development costs across firms. As explained above, every one of the six high-cost firms submitted complex proposals that either involved caps on air pollutants and permit pre-approval or multiple facilities, while just one of the low-cost firms submitted such a proposal. Most of the other 11 correlations we have identified can be explained as having arisen either because certain types of firms and facilities were more likely to submit complex proposals, or because such proposals shaped the project development process in specific ways. In the lexicon of Section 2, we argue that the complexity of proposals had a 'direct' impact on costs, while most of the other explanatory variables that appear to be correlated with costs only had 'indirect' impacts that operated through the complexity of the proposal.

More specifically, rapid innovators were more likely to submit complex proposals involving caps on air pollutants and permit pre-approval because they incurred extremely high costs as a result of CAAA Title V requirements to re-permit each time the production process changes. Rapid innovators were also more likely to have voluntarily put in place certified EMS systems and community advisory panels in an effort to reduce chronically high regulatory costs. Large firms/facilities were more likely to submit complex proposals since they had both the scale and the environmental management personnel needed to develop complex proposals. Firm and facility size was correlated with market leadership and market concentration. Finally, since each stakeholder group made decisions as to whether to hire a facilitator and whether the process would be consensus-based, one would expect complex and contentious proposals to have provoked calls for a consensus-based process and for hiring a professional facilitator.

Notwithstanding this explanation of our results, we would note that firm and facility size, use of a consensus-based stakeholder negotiation process, market share, percentage of county employment, and proximity to an environmentally sensitive area may have had direct positive impacts on costs that complemented their indirect impacts. Large firms and facilities may have incurred greater costs because regulators and other stakeholders were more concerned about granting regulatory flexibility to firms/facilities with substantial aggregate emissions and high visibility. Firms that relied on consensus-based decision making rules may have incurred greater costs during the stakeholder and approval process as a result. Facilities that employed a relatively large share of county workers may have incurred lower project development costs because they had more bargaining power with local regulators and stakeholders. Finally, firms located next to environmentally sensitive areas may have incurred greater costs because regulators and other stakeholders were more concerned about granting them regulatory flexibility.

6. Conclusion

By way of conclusion, we first summarize our findings. We found that on average, project development costs totaled approximately $350,000 for firms and $110,000 for EPA regional offices. For firms, roughly half of these costs arose from dealing with EPA while stakeholder negotiations—the focus of considerable attention in the literature—only accounted for one fifth of total costs. Furthermore, we found that obtaining final approval from EPA was the key bottleneck for high-cost firms. Our respondents were in broad agreement that two issues associated with project development were responsible for raising costs: lack of coordination among EPA offices and lack of clarity about the requirement of superior environmental performance. Finally, after considering a wide variety of characteristics of the project proposal, the facility, the firm, and the negotiation process, we concluded that the complexity of project proposals drove differences in project development costs across firms. In particular, costs were high for firms that submitted proposals that either involved caps on multiple air pollutants or multiple facilities.

An important caveat to our findings is in order. When Project XL was launched in 1995, the project development process was by all accounts ill-defined and poorly managed. Over time, as discussed in Section 1.2, the EPA has taken a number of steps to mitigate these problems. As a result, some project development costs may be lower today than they were for our survey respondents. This complication begs the question of whether our findings are still relevant.

To find out, a follow-up survey on transactions costs incurred by current program participants would be needed. But in our opinion, such a survey would find that although average project development costs are somewhat lower today, they are still quite significant and moreover, the principal drivers of these costs have not changed over time. In particular, follow-up research would likely find that: (i) obtaining final approval from the EPA is still responsible for the lion’s share of transactions costs, and (ii) complex proposals are still the most costly to shepherd through the approval process. The reason is that—notwithstanding EPA's attempts to clarify guidelines and to “reengineer” the approval process (60 FR 19872; 64 FR 16845-52)—the key problems that underlie these findings have not yet been resolved.

With regard to final approval problems, the experience of recent project participants clearly illustrates that the EPA has not eliminated this bottleneck. Of the 16 projects waiting for final approval in December 1999, two had been waiting more than four years, three had been waiting more than three years, and five had been waiting more than a year (US EPA, 1999a). Lack of a legislative foundation for Project XL and a lack of buy-in among EPA staff have been widely blamed for raising the costs of obtaining final EPA approval. Both problems persist (Inside EPA, 1999; The Reinvention Report, 1999b).

Key problems that have raised project development costs for firms submitting complex proposals also remain unsolved. For example, the EPA's attempt to establish clear guidelines regarding "superior environmental performance" (60 FR 19872) have fallen short of their goal since they have waffled on the key issue of how baseline environmental performance should be measured (Cabellero, 1998, 406). Also, difficult issues that inevitably arise in evaluating proposals for plant-wide caps on air emissions—how to set the caps, whether to allow cross-pollutant trading, how often to require repermitting, and how to monitor compliance—remain difficult to address except on a case-by-case basis.

What do our findings imply about the viability of Project XL and, more broadly, the viability of site-specific performance-based regulation? They constitute 'good news' in some respects and 'bad news' in others. The good news is that, although we found that the costs of project development have been significant, our survey results indicate that the one part of the process that many critics have identified as a potentially most costly and most difficult to manage efficiently—stakeholder negotiations—has not been a major component of costs. Rather, a considerable percentage of costs have been due to problems with EPA's management of the initiative.

But our results constitute bad news as well. We found that the complexity of the project proposal may well have been the key determinant of project development costs. To the extent that complexity is correlated with innovation—and judging from our sample there does appear to be a strong correlation—this implies that innovative proposals are likely to be the most costly. This does not bode well for EPA's prospects of remedying one of the often-cited weakness of Project XL: its inability to attract proposals that, if transferred, could have a significant impact on the efficiency of the regulatory system as a whole.

A second troubling implication of our findings is that, given that participating in Project XL has been costly and that pushing through the most beneficial type of project agreements has been especially costly, one would expect the initiative to be biased in favor of large firms. Such firms have financial and human resources and economies of scale and scope that lower the costs and increase the benefits of participation relative to smaller firms. The fact that virtually all of the firms in our sample are relatively large (Table 7) confirms this hypothesis.

It is important to note that in certain respects this 'anti-competitive bias' may be inevitable if not beneficial. According to the EPA, the goal of the program is to transfer regulatory innovations that are tested in Project XL. For example, efforts are now underway to make air emissions caps broadly available (Inside EPA, 1998). Presumably, small firms will eventually be able to take advantage of the efforts of larger firms to spur regulatory reform. Hence, the competitive advantage that large firms get from participation in Project XL could in theory be temporary and best thought of as a return on their investment in regulatory reform, analogous to the return that inventors get from patents (Blackman and Boyd, 1999).

The policy prescriptions that flow from these conclusions are straightforward. In order to achieve either the ambitious goal of making Project XL a viable 'regulatory blueprint' for site-specific regulation, or the less ambitious objective of ensuring that it serves as an effective test-bed for policy innovations, EPA must clearly demonstrate that the cost of project development can be reduced. Despite EPA's many reforms, there is as yet no extensive record to indicate that the process will be less costly for future participants. Unfortunately, judging by the number of proposals that have been submitted to the program by private-sector facilities in the last several years, the experience of the first group of participants seems to have biased industry's perception of the program. In addition, it may have seriously damaged support for the program inside the agency. The challenge for EPA will be to change the negative perceptions of both sets of stakeholders by ushering a second group of XL participants through the project development process in short order and at relatively low cost. Just as important, EPA must demonstrate that costs can be reduced for innovative proposals as well as prosaic ones, that small firms can participate, and that the benefits of regulatory innovations can be transferred.

Our study also suggests, that given the need to find ways of reducing the costs associated with developing XL projects, EPA would benefit immensely from developing a reliable mechanisms to track costs—both those incurred by firms and by the EPA. As yet, there is little public information available, and very little analysis of the costs incurred by EPA headquarters, including program offices outside of the Office of Reinvention.

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Appendix: Data sources

Table 6. Characteristics of project proposal

All variables. US Environmental Protection Agency, 1998, Final Project Agreements. Office of Reinvention. Available at: http://yosemite.epa.gov/xl/xl_home.nsf/all.

Table 7. Firm, facility, and stakeholder process characteristics

Rapid innovator. (yes/no) US Securities and Exchange Commission, 1998, Form 10-K Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 for the fiscal year ended December 31, 1997, part I, item 1. Edgar database. Available at: http://www.sec.gov/Archives/edgar/data (search on company name). Firms designated "rapid innovators" on the basis of information in the sections on industry, products, manufacturing, competition, and research and development.

Number of Employees. (fiscal year 1997) Hoover's Online, 1998, Hoover's Company Capsules. Available at: http://www.hoovers.com.

Top three market share. (yes/no) US Department of Commerce, 1992, Concentration Ratios in Manufacturing, MC92-S-2, Subject Series, Bureau of the Census, Economics and Statistics Administration, Table 3.

Pollution intensity rank. (pollution control expenditures / total shipments *100; both in $ 1994 at four digit SIC level). Pollution control expenditures are from: US Department of Commerce, Pollution Abatement Costs and Expenditures, 1994, MA200(94)-1, Current Industrial Reports, Bureau of the Census, Economics and Statistics Administration, Table 7. Total shipments are from: US Department of Commerce, 1995 Annual Survey of Manufacturers. M95(AS)-2, Bureau of the Census, Economics and Statistics Administration, Table 1. Available at: http://www.census.gov/prod/2/manmin/asm/m95as2.pdf.

Publicly traded. (yes/no) US Securities and Exchange Commission, 1998, Form 10-K Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 for the Fiscal year Ended December 31, 1997, Edgar database. Available at: http://www.sec.gov/Archives/edgar/data.

Market share largest 8 firms. (percent) US Department of Commerce, 1992, Concentration Ratios in Manufacturing, MC92-S-2, Subject Series, Bureau of the Census. Economics and Statistics Administration, Table 3.

Other voluntary agreements. (yes/no) Resources for the Future, 1998, Survey data. (hereafter 'RFF, 1998'); US Environmental Protection Agency, 1998, Final Project Agreements, Office of Reinvention, Available at: http://yosemite.epa.gov/xl/xl_home.nsf/all.

Non-compliance history. (yes/no) US Environmental Protection Agency, 1998, Envirofacts Warehouse available at: http://www.epa.gov/enviro/index_java.html. This internet site allows users to electronically retrieve environmental information at the facility level from EPA databases on Superfund sites, drinking water, toxic releases, air releases, hazardous waste, Biennial Reporting

System data (also hazardous waste) and water discharge permits. Facilities were designated as having a "non-compliance history" if any of these data indicated non-compliance.

Number employees. RFF, 1998.

Certified EMS system. (yes/no) RFF, 1998.

County personal income. ($) US Department of Commerce, 1996, County Profiles 1996. Bureau of the Census, Available at: http://www.census.gov/statab/USA96.

Percent county employment. (facility employees / county employment) Facility employees from RFF, 1998. County employment from US Department of Commerce, 1996, County Profiles 1996, Bureau of the Census. Available at: http://www.census.gov/statab/USA96

EHS Staff Size. RFF, 1998.

Miles to nearest town. RFF, 1998.

Adjacent to residential areas. (yes/no) RFF, 1998.

Adjacent to environmentally sensitive area. (yes/no) RFF, 1998. Imation's facility is located in a CAAA 'serious' non-attainment area for ozone, Merck's facility is located 10 kilometers from Shenandoah National Park, a Class I Prevention of Serious Deterioration (PSD) area, Weyerhaeuser's facility is located in a Class I PSD wetlands area, and Berry's facility is adjacent to a Class I PSD river.

All Stakeholder negotiation process variables except pre-existing CAP. US Environmental Protection Agency, 1998, Final Project Agreements, Office of Reinvention. Available at: http://yosemite.epa.gov/xl/xl_home.nsf/all.

Pre-existing CAP. (yes/no) RFF, 1998.