Keeping Pace with Innovative Industrial Program: Assessing Complex Program Deliveries and Strategic Energy Management Programs

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ABSTRACT

This paper discusses the theoretical approaches and applied research framework employed to evaluate an innovative industrial sector program that includes multiple behavioral program components. Industrial sector program managers are developing increasingly more complex program designs that deliver resources, operations and maintenance (O&M), and strategic energy management (SEM) components. The delivery of these programs often requires coordination of multiple technically competent implementation and delivery contractors. In response to these concerns some program managers are developing processes and roles to coordinate and organize their contracted services in an attempt to sustain positive relationships between their programs and the market; and program managers often view the health of these relationships as important, if not more so, at generating program savings than are the quality of program components. This paper describes the value of developing action models (Chen 2005) to assess the usefulness of program tactics, resources, and processes across a program's components, and offers these models as a means to relate programs' organizing principles for resources, staff, and contractors to programs' assumptions about market wide barriers. Additionally, an applied research framework is provided that helps to structure evaluation research questions around issues of both program design effectiveness as well as assessing the effectiveness of the organization and coordination of program activities.

Introduction

This paper leverages an evaluation commissioned by the Bonneville Power Administration (BPA) for its industrial sector portfolio called Energy Smart Industrial (ESI). This paper focuses on the evaluation challenges posed by new and evolving industrial programs in general, and the experiences of the evaluation team as it approached the evaluation of the ESI program. Many new industrial programs include delivery of strategic energy management components and other behavioral focused initiatives that may prove challenging to evaluate. Evaluators must assess the integrated value of multiple program components at both a participant and market wide level, and assess the effect that delivery approaches have on the market's relationship to the program.

Bonneville Power first implemented ESI in 2009, and in addition to resource based program components (i.e., standard custom projects), the program includes many industry leading efficiency components including targeted O&M, program support for an onsite energy manager, and SEM training delivered through cohort instruction. The ESI program was a redesign of BPA's prior industrial program efforts to overcome ongoing barriers to customer action and internal (BPA) organizational barriers that limited the effectiveness of previous efforts. The primary program change occurred when the program contracted with a program implementation contractor to deliver the program; BPA had delivered the prior program. And as the program's design began to emphasize more energy savings from behavioral components, the program hoped to develop closer relationships with its end users and customer utilities. This led the program to develop new strategies and tactics to improve these relationships; and these evolving program processes ultimately put pressure on the evaluation's approach.

Additionally, the ESI program offers an excellent study opportunity for the evaluation community because BPA implemented it across 74 utilities[1] and dealt with implementation challenges specific to utilities with small, medium, and large sized territories; and utilities with differing levels of industrial energy efficiency experience. Furthermore, this evaluation was buoyed by the program's development of a program logic model and program implementation manual. Bonneville Power developed the model and manual during program design, supported by early coordination with an evaluation contractor and by input obtained through several focus groups with utilities and end users to understand the market barriers. (The Cadmus Group, Inc. 2010).

Readers' Note

Bonneville Power is a federal energy marketing agency that sells energy directly to utilities. To prevent confusion, the authors refer to industrial customers as "end users," or industrial end users; and refer to participating end users as "participants". Utilities opt-into the program, and when it is necessary to distinguish between utilities enrolled in the program, versus those that are not, we refer to enrolled utilities as "participating utilities."

Challenges Evaluating Complex Industrial Programs

While simple in its purpose, the practice of evaluation is ironically challenging when applied to industrial sector energy efficiency programs. In general terms, evaluation may be described as the systematic examination of accountability (Alkin and Christie 2004). However, conventional evaluation approaches—which often rely on linear perspectives of program component maturation—may fail to capture the nuanced qualities of industrial sector programs. Similarly, Chittum notes that "industrial energy efficiency programs will more tightly integrate resource acquisition and market transformation efforts seamlessly into customer engagement. Such programs may be too nuanced for some of the evaluation methodologies in place today" (Chittum 2012, iv). And as the quality of industrial program/end user relationships effect the overall willingness of end user to focus on energy and pursue energy efficiency (Chittum 2012, 2009), process evaluators ought to select approaches that help them to examine the broader effects that industrial program offerings and activities have on program/end user relationships and on end users' focus on energy use.

Unique Aspects of Industrial Programs

The energy behaviors, opportunities, and decisions made by industrial end users greatly differs from other sectors and necessarily influence the design of industrial efficiency programs. Research demonstrates that industrial end users, as compared to other sectors, are "more technically sophisticated… and generally more knowledgeable about their energy use" (Chittum 2009, 8), as well as have higher load factors that typically reduce the costs of achieving energy savings. Additionally, new efficiency technologies, processes, and production growth ensure cost effective saving opportunities reoccur at facilities where deep energy savings have been achieved (Shipley and Elliot 2006). However, barriers to industrial energy efficiency persist, and include lack of high level technical skills to identify and implement efficiency projects, lack of available capital for efficiency projects, and end users' perceived risks associated with changes to existing production processes (Chittum 2009). The very

[1] Following the close of the initial evaluation period (June 2011-May 2012) the ESI program implementation expanded to included 103 utility service territories in total.

structure of industrial sector markets differ compared to other sectors, as a few regional industrial firms typically have a very large energy demand.

Industrial program designers invariably leverage these aspects of the industrial sector when developing SEM program components focusing on whole-system impacts and sustained outcomes for each of the participating end users they work with (Jones 2011). Similarly, the ESI program manager stressed the importance of industrial sector programs to maintain strong relationships with the markets (utility and end-user) they serve (Eskil 2011). This means that industrial sector program managers are focused on the relationship building capabilities of their program and its partners (who deliver program components), in addition to concern over program project counts. This context added additional goals for the evaluation of the ESI program, such as an examination into the effectiveness by which the program and its contractors managed the program's interactions and relationships with the market, as well as evaluating the effectiveness of the program overall.

We generated specific research topics from the research commissioned by the ESI program that identified key barriers and challenges faced by the program (Eskil 2011), which are likely shared by other industrial sector programs. These program barriers and challenges include:

- **Weak focus on industrial energy efficiency:** Utilities' and end users' strategic focus often concerns business areas other than industrial energy efficiency. Many utilities focus on less technically complex residential and commercial energy efficiency programs; and industrial end users typically focus their efforts on operational output, rather than energy consumption.

- **Resource constraints**: Industrial projects are often costly and technically complex. Utilities and end users lack both the financial and staffing resources needed for successful industrial energy efficiency projects.

- **Risks posed by energy efficiency projects**: Industrial projects affect complex end users' operations, sometimes requiring several years to complete. Unpredictable and long project completion timelines pose risks to utilities' budgeting processes, as they are obligated to pay incentives at project completion. End users are sensitive to the risks that efficiency projects pose with changes to their operations, and whether savings will materialize for capital-intensive projects as predicted by program stakeholders.

- **Mistrust in BPA industrial energy efficiency programs**: Industrial end users and utilities' mistrust of BPA programs historically stem from: 1) confusion about the program from unclear and non-standardized marketing collateral used to explain program guidelines and incentives (The Cadmus Group 2010); and 2) BPA lacked enough technical staff to deal with the volume of potential industrial projects (The Cadmus Group 2010).[2]

The overarching picture this research describes is that while industrial end users are technically sophisticated, their resources and focus tend to concern business and production rather than energy efficiency; and the sensitive and complex nature of industrial projects and processes cause end users to be very cautious about the projects they consider and the program staff they work with.

ESI Program Structure

[2] Bonneville Power Administration, *Energy Smart Industrial Fact Sheet for Utilities*, Oct. 2010; pg. 1.

We briefly describe the ESI program's components and its delivery mechanism has been briefly described to provide the reader with an understanding of how the program proposed to overcome the above barriers. Figure 1 summarizes the program tracks included in the ESI program as of 2010. The program offers a Custom Projects track through which technical analysis services and incentives are offered to end users to help reduce the cost of capital projects.

An Energy Management pilot program offered the following behavioral components, all of which included program supplied technical services and incentives: *Energy Project Manager* that helps to fund end-user staff with dedicated roles to identify and promote energy efficiency projects; *Track and Tune* that provides technical support and incentives for O&M savings; *and High Performance Energy Management* that involves training designed to focus corporate management and culture on energy efficiency. The Trade Ally Driven track offers incentives for program qualified equipment upgrades for small industrial projects, lighting measures, and motor rewind services; trade allies delivered these components.

The key role for the delivery of all these program tracks is the Energy Smart Industrial Partner (ESIP) role, which serves as the programs' single point of contact for all end users and utilities. The program's implementation contractor supplied 13 individual ESIPs, and these field engineers act as technical account managers to utilities and end users as ESIPs promote the program to both of these market entities, and support project and program activities. Each ESIP is selected for their industrial specific experience to match specific participants, and are expected to possess "excellent communication skills and the ability to develop trusting relationships" (Eskil 2011, 68).

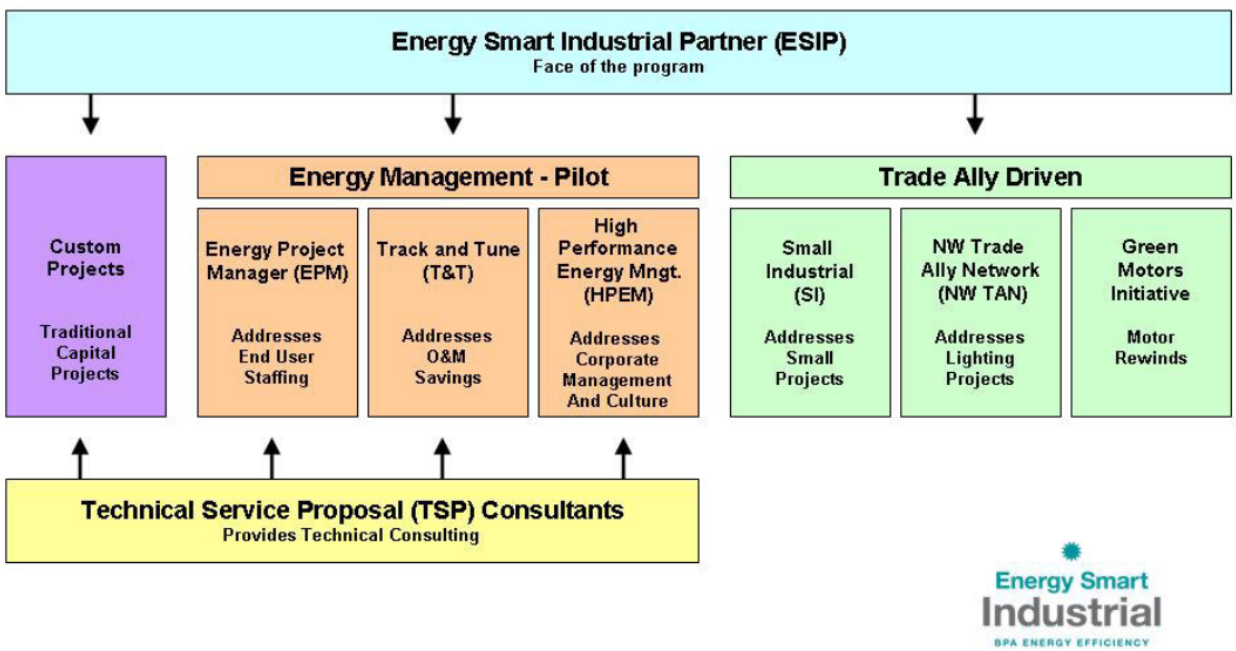

Figure 1. Energy Smart Industrial Program Components and Delivery Mechanism (Eskil 2011)

Developing an Evaluation Approach

The goals of the process evaluation led to substantive considerations on the part of the evaluators to develop theoretical perspectives and methodological approaches for this investigation. Throughout the evaluation process, evaluators typically assess the potential *methodological, use*, and *value* perspectives—elements of the evaluation tree (Carden and Alkin 2012, Alkin and Christie 2004)—of their work. Hall (2013) further argues that during these exercises evaluators ought to conceptualize and develop their research frameworks and methods that are used to link to, and support the inquiry into these higher level values. In order to achieve the broader nature of process evaluation set out by Davidson, who describes process evaluation as "a critical look at the quality or value of everything about the program" (Davidson 2005, 56), the evaluation focused on the connection between the ESI program's goal accountability and process accountability (Alkin and Christie 2004). According to Alkin and Christie, goal accountability concerns the appropriateness of program goals, and process accountability concerns the appropriateness of procedures in place to accomplish those goals. Following a review of the ESI program's materials and prior evaluation work, the evaluation team determined the most valuable evaluation approaches included in the development of a program action model (Chen 2005) and applied reporting framework focused on the program's organizing structures. The action model contributes *conceptual use* (Peters 2011) value that helps to rationalize the program's design in relation to its goals, and further informed the direction of the evaluation. Additionally the evaluation team designed a reporting framework that contributed *instrumental use* (Peters 2011) value for the continued management and improvement of the program.

ESI Evaluation Action Model

Austin (2007) uses an action model to describe the program theory for Southern California Edison's Local Government Partnership Program. Austin characterizes logic models, referred to as *change models*, as effective at describing the "causal processes" of and intervention assumed to help a program component achieve its goals or outcomes. The paper differentiates logic models from action models, which are a higher level description of the "prescriptive assumptions of the components and activities necessary to a program's success" (618). Action models describe the association of program resources, organizations, and implementers as it relates to the assumptions of the way targeted social problems will respond to program interventions in the market environment.

Action models are valuable for describing program theories for industrial sector programs with SEM components because these types of programs in the long-term generate savings from the cumulative effects programs have on industrial organizations. Furthermore, the ESI program targeted specific market and end-user barriers and challenges that it sought to overcome with its program's design. Additionally, the program's theory assumed the delivery mechanisms—such as the ESIP role, in addition to program components, would help to overcome identified market barriers. Lastly, the program's design focuses on the developmental stages of end users' organizational cultures as it relates to energy efficiency. And while these stages are linear, the developmental routes end-user organizations undergo are specific to the barriers affecting their energy efficiency behaviors, and their relationship with the program. Taking these factors into consideration the evaluation team developed an action model that describes the program's assumptions as it relates to the:

- Potential cumulative program effects of all program components across end users' firms
- Value of key implementation roles in relation to targeted barriers and program strategies
- Strategic value of key program resources and processes to deal with market barriers
- Value of program resources, processes, and implementers contextualized in market terms

To achieve these goals the evaluation team constructed a modified action model that relates program strategies and tactics to the market barriers (explained above in *Unique Aspect of Industrial Programs*) targeted by the program. The ESI's program action model is represented by Figure 2, which displays the four targeted market barriers comprising the core of the figure; and the second *inner ring* represents the strategies to address these barriers. The *text callouts* are the specific tactics the program employed to implement the strategies and reflects the strategic value of various program resources, processes, and roles. The outer *grey ring* represents the recursive nature of program participation, and the cumulative effect of program tactics on the market place. Utilities and end users experience various program tactics that help them to overcome various barriers. And repeated program participation in various forms helps move end users through stages of energy efficiency focus: beginning with 1) Firms that identify savings opportunities; 2) Firms that also monitor energy use; 3) Firms that also have institutional energy management.

We have modified this action model to focus on the linkage between market barriers and associated program strategies by implying the roles for the program's administration, utilities, and end-user firms. The ESI program manual is thorough and clearly outlines the structure and interactions between the program and program implementation contractors; as such, we did not include these relationships in the model. And the tactics in the callout text further elaborate how the program's interventions help participating utilities and end users overcome targeted barriers.

The value of the action model becomes apparent as one 'walks through' an example of the program touch-points involved with a typical project. For example, a custom project may begin with a scoping study performed by an ESIP or Technical Service Provider (TSP) to identify savings opportunities at end user sites. The ESIP manages program activities on behalf of participating utilities and end users; and program incentives help utilities and end users overcome financial constraints associated with implementing energy efficiency projects. The project tracking database help utilities better predict when projects will be completed, which helps them to overcome risks associated with committing funds to proposed projects. And the TSP quality assurance scoring system favors TSPs who deliver more precise project savings estimates. TSPs are scored based on the similarity of their project savings estimates with the actual savings delivered by these projects, and more precise estimates reduce risks posed to utilities who allocate funds based on TSPs' project savings estimates and pay incentives based on actual project savings. Lastly, the program's utility account plan sustains utilities' trust in program activities by giving participating utilities oversight over a single point of contact through the ESIP role; and the technical expertise and reputation of ESIPs and TSPs help end users trust the services they receive through the program.

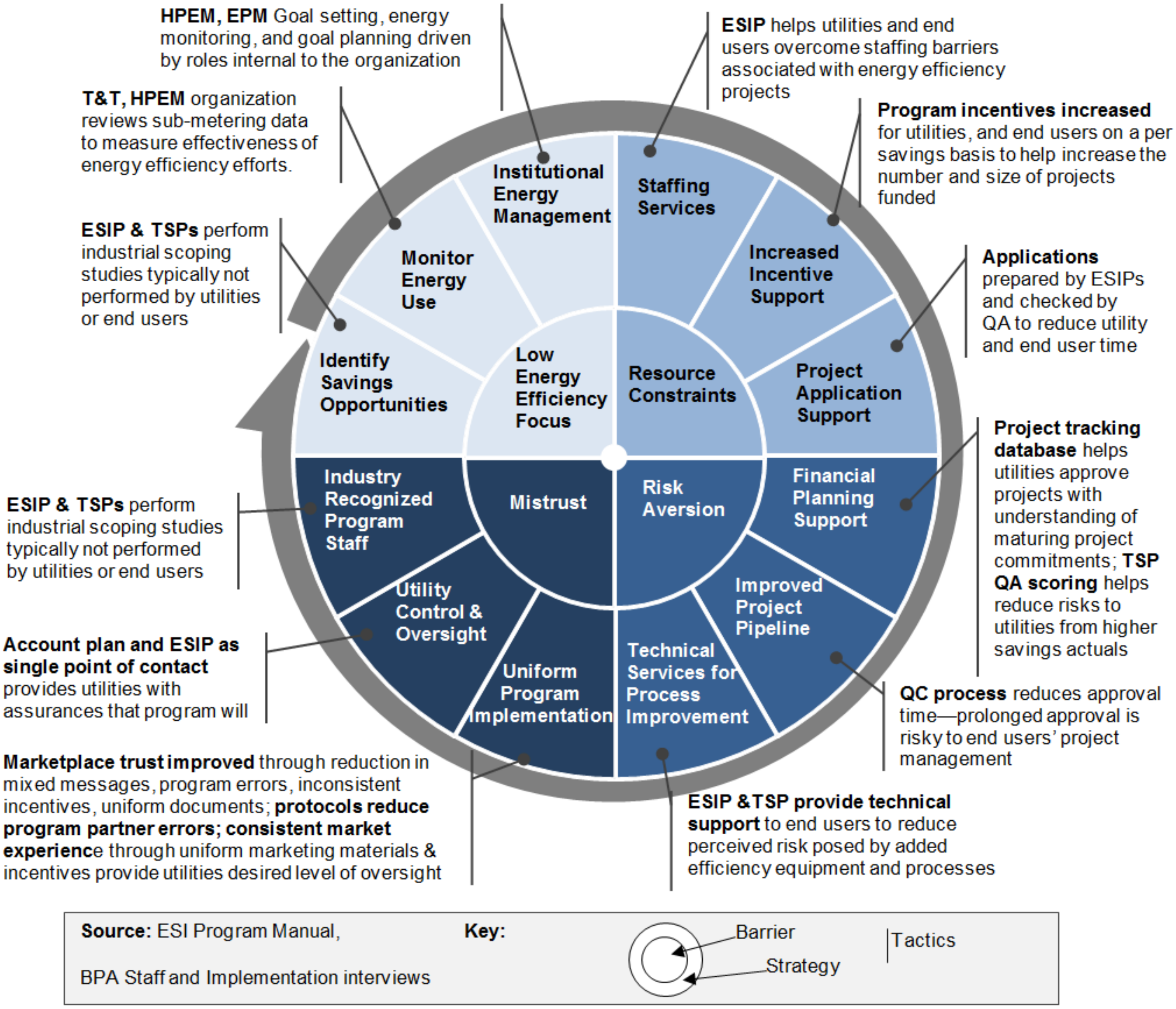

Figure 2: ESI Program Action Model: Strategies and Tactics to Overcome Market Barriers

Evaluation Research Framework

The evaluation team developed a research framework (Table 1) with the intent of organizing research findings into the two distinct areas of program control: Program administration, and implementation firms. We derived key elements of program control and role responsibilities from interviews with the program and implementation staff, and review of the program's manual and developed research questions (Table 1**)** from these elements. Also, we included a section of research questions to further asses the effectiveness of the program's design, having generated questions from interpretations of the action model. Furthermore, the framework improved the ability of the evaluation team to triangulate findings between data sources, by providing additional context structuring the roles of interview and survey contacts.

Table 1: ESI Program Evaluation Framework and Research Questions

Program Administration	Implementation Firms	Design Effectiveness
How effectively processes support BPA staff in their roles to: • **Organize** program resources through planning, documentation, and data management • **Oversee** implementer and program activities and take corrective when necessary	*How effectively implementer activities:* • **Develop the market** through outreach and relationship development, identify and track savings opportunities, develop technical services base • **Deliver the program** to the market through scoping studies, project management support, and assigning technical services • **Document activities** including communications with customers, project proposals, completion and M&V reports	*How effectively the program design:* • **Drives participation** by overcoming market barriers • **Supports program activities** through effective processes • Produces **sustainable program** components • Achieves high levels of **program satisfaction** and improves market interest in the program

Findings

We conclude here with a discussion of the meanings for these research questions and summary ESI program evaluation findings to assist other evaluators in employing this framework and research questions. We also present some findings more specific to ESI.

Program Administration. For this program, program administration describes BPA's activity managing the ESI program. BPA staff described the complex delivery of their program, which relies on several different contracted program partners to deliver multiple program components. Furthermore, they emphasized that program participants form opinions about the program through the many experiences they have with program partners they come into contact with. BPA staff stressed the importance of including the following research concepts in the ESI process evaluation: *organization,* which concerns the program's coordination program activities through clearly defined roles to help reduce confusion between program partners; and *oversight,* which is the extent to which program administrators ensure that program partners follow the guidelines set out by the program.

For the ESI program, we found that the program's organizational protocols and oversight procedures were critical to ensuring positive relationships between the program and its utilities and end-users. The program developed clear organizational processes which were articulated through its program manual; program roles were well defined and distinct; and the program developed processes to document and follow relationships developed by implementation staff. Furthermore, BPA program staff regularly enforced these organizing principles through oversight activities which included: BPA program staff regularly meeting to review the quality of implementer staffs' engagements with utilities and end-users, and BPA's program manager met with the implementation's management to ensure corrective actions were carried out for all challenges identified by the program's staff.

Implementation Firms. Bonneville Power's ESI program manager explained the primary contracted implementation firm is expected to "be the face of the program without being the program." This means that the implementation firm needs to work with the market in such a way that the market identifies the program with BPA and not the implementation contractor. The evaluation team included this aspect in its assessment of implementers' activities across the following three implementer functional roles that roughly correspond to a chronological staging of implementation activities. Implementation firms are expected to *develop the market* for program participation. This includes developing relationships with, and promoting the program to utilities and industrial end users; identifying savings opportunities; and developing a technical service base to deliver program components. Once implementers have laid this foundation they *deliver the program* through various support of project implementation. Lastly, implementers need to *document* their activities that may include project completion and M&V reporting; and in the case of ESI systematically document their communications with utilities and end users so the program's administration can perform oversight of implementers' activities. The program was effectively implemented in these ways, except for one remote region where participant surveys indicated support for project implementation was less substantial.

Design Effectiveness. Design effectiveness as a concept concerns the success of a program at achieving goals instrumental to its success. Research questions considered in this domain concerned the effectiveness of various program resources and components to *drive program participation* by overcoming market barriers, usefulness of program processes to *support program activities*, the likelihood of program components and incentive structures to be *sustained* overtime, and the ability of the program to produce and sustain high levels of *participant satisfaction*.

Program participation was driven by expanded technical and project support made possible by the ESIP role, and market perceptions that the program's design targets comprehensive savings. Conversely, participation was moderated by market concern over perceived risks associated with long project approval times. Program training and resources for SEM participants helped to ensure more sustained behavioral initiatives were undertaken. And high levels of participant satisfaction were driven by the quality of technical and project support, much of which was provided by the ESIP role.

Conclusions

Development of research frameworks prior to evaluations' data collection enables evaluators to triangulate multiple perspectives across data sources. The framework in Table 1 supported our triangulation of findings for the evaluation of the ESI program. We have presented our framework and research questions in a generalized form germane to the evaluation of other industrial programs involving SEM components, as well as illustrating our approach with ESI-specific findings.

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