

# INSTITUTIONAL ASSESSMENT OF TECHNOLOGY PROGRAMS

**Andrew D. Reamer**

Fundamentally, economic development is about *institutional development*. That is, the goal of truly effective economic development ultimately is not about attracting new companies or finding new international markets for firms. The aim is to *stimulate the development of smart, flexible, and competitive businesses*. These firms will have the internal capacity to successfully adjust to changes in market conditions and quickly take advantage of market opportunities as they arise. Such firms must form the core of any healthy economy. Industrial modernization services have an important role to play in the development of competitive firms.

In the last several years, in large part under the direction of the National Institute of Standards and Technology, a healthy and creative discussion has been ongoing with regards to how to measure the impacts of industrial modernization programs in the U.S. That such long-term, focused work in designing metrics is necessary indicates the degree to which impact evaluation has been an afterthought, or a non-thought, in the operation of the great majority of economic development programs in this country. Clearly, as demonstrated at this workshop, the industrial modernization movement is in the forefront of creating useful economic development program evaluation methodologies.

This chapter contributes to this conversation by laying out the conceptual framework for a three-pronged approach to the evaluation of industrial modernization programs. This particular framework has been utilized by Mt. Auburn Associates to carry out evaluations of economic development programs operated by the U.S. Economic Development Administration and a number of states, including Ohio, New York, Iowa, and Oregon. The framework reflects the assumption that the fundamental purpose of the evaluation is to assist the evaluated institution in *understanding how it can design and operate highly effective programs*. The evaluation framework is designed to generate sufficient information to allow the reviewers to be *prescriptive* with regard to program design, structure, and operation, and the organization and management of the institution behind it.

**Andrew D. Reamer is a principal and founder of Mt. Auburn Associates, an economic development consulting firm.**

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This approach to evaluation is really one of *institutional analysis*. To be effective, modernization services must display the same type of characteristics -- intelligence, flexibility, speed -- as those they are seeking to stimulate in their client firms. Program effectiveness is very much a function of the characteristics of the institution that operates the program.

The three dimensions of the evaluation analysis are:

- ! **Appropriateness** -- Is the program addressing appropriate market needs, at the appropriate scale of operations, and using the appropriate tools? In other words, is the program being aimed at the right targets with the right number and type of tools?
- ! **Effectiveness** -- What has been the impact of the program's services on its constituency's operations and performance? In other words, how well is the program hitting the targets? Moreover, if the publicly-supported program did not exist, to what extent would firms find ways to improve operations and performance using other resources? Put another way, what is the program's true "value added" to the current array of public and private sector resources?
- ! **Organization and management** -- What factors in the organization and management of the institution explain the appropriateness and effectiveness of current operations? In other words, why is the institution choosing and hitting its program targets as well, or as poorly, as it has?

In the next several sections, this institutional approach to program evaluation is explained in greater detail. To illustrate the implementation of the approach, examples will be drawn from Mt. Auburn's evaluation of Ohio's eight Thomas Edison Technology Centers. These nonprofit, membership-driven Centers, now a decade old, are supported by the state, are based at universities or other technology development nonprofits, and focus on the development and diffusion of a specific type of technology. Center specializations include plastics, welding technology, biotechnology, advanced materials, and advanced manufacturing.

The Centers were originally conceived as university-based, technology development, supply-push organizations, with the hope of emulating the success of Silicon Valley, Research Triangle, and Route 128. In recent years, however, the state has asked them to become more oriented towards demand-pull, technology diffusion, and small firms. At the time of the evaluation, a number of the Centers had not yet fully institutionalized the new paradigm, and the state had not given clear direction on how to make the transition. Mt. Auburn's primary charge was to evaluate each of the Centers as individual technology transfer institutions, and secondarily to provide recommendations to the state on the design and operation of its Edison Center Program, essentially a funding program providing a significant portion of Center annual budgets.

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## Appropriateness Evaluation

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A comprehensive appropriateness evaluation has a number of dimensions. The first concerns the appropriateness of the *primary constituency* of the organization's programs -- is it targeting its services to the population most in need of its services, deserving of public subsidy, and of strategic economic value? In Ohio, while the state believed that the technology development and diffusion needs of small manufacturers were significantly underserved, a number of Edison Centers had become dominated by large firm R&D managers, who had little interest in serving the needs of smaller firms.

The second dimension concerns the appropriateness of the *needs for assistance* being targeted in the constituent population -- is the program addressing needs that are not adequately being met by other private and public resources due to some form of market failure? Have such market failures been validated through market research, or are they perceived on the basis of belief and anecdote? Market failure means that the workings of the market are not resulting in an optimal allocation of resources, and become the rationale for

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government intervention. Sources of market failure are several, and can include (but are not limited to):

- ! Lack of information -- for example, small manufacturers may not know how to access appropriate technical assistance;
- ! Externalities -- for example, some small firms may not be able to afford the cost of private consultants, but the public benefits of their being assisted are not reflected in the price of assistance, and so they are deserving of public subsidy;
- ! High transaction costs -- lack of small firm resources (staff and time) inhibit firms from identifying and obtaining appropriate assistance;
- ! Lack of a marketplace -- the government or public universities may have technologies it wishes to share with the private sector, but there are no institutionalized means to do so;
- ! Economies of scale -- there are greater economic efficiencies in the government providing assistance than in the private sector doing so; and
- ! Risk averseness -- small firms are risk averse in seeking change and assistance to manage that change, and it is in the public interest to share the costs, and so the risks, of managing change.

In Ohio, a few Centers had carried out a needs assessment of its constituent population, but most had not. Very importantly, the state had not carried out a needs assessment of the state's manufacturing firms, and so was basing its program guidance on belief, not analysis.

The third dimension of appropriateness evaluation concerns the *fit between the needs of the constituency and the program tools utilized*. The specific tools used should match the actual market failures. For instance, subsidizing technology development is not appropriate if the true constituent need is finding and adapting commercially available technology. This particular issue arose for some of the Edison Centers.

Moreover, tech transfer tools should be *linked to complementary resources that focus on factors other than technology*. As several observers note, successful modernization is a function of a firm's

ability to manage simultaneous change in a number of dimensions -- market assessment, finance, technology, skills enhancement, management practices, the organization of the workplace, and relationships with other firms. Programs that focus on technology transfer should not work in isolation of resources that can assist firms in strategic analysis (to what end the technology is needed), finance (how to pay for it), skills enhancement (how to train the workers to use it), and workplace organization (how to build teams to manage the technology). Again, only a few Edison Centers took the linked multidimensional approach to modernization assistance.

Fourth, programs can be examined with regard to the extent to which their efforts are *guided by a regional strategy for industrial competitiveness*. In economic development circles, there often is confusion between tools and strategies, with the former being perceived, incorrectly, as the latter. Strategies identify, as specifically as possible, where the region wants to go, why, and how. Tools, such as modernization services, are means for getting there. The development of a state or regional industrial competitiveness strategy requires ascertaining the structure, strengths and weaknesses of the area's manufacturing sector, identifying key market opportunities, indicating goals with regard to changes in the structure and capacity of the region's manufacturers, discussing the tools needed to achieve those goals, and pointing out the means by which development organizations can work together in implementation. Development tools should include, but are not limited to, modernization services. The absence of overall picture of regional economic goals leaves a modernization service without means to more effectively target its services. Ohio and its regions lacked a manufacturing industry strategy; hence, the Edison centers essentially acted as free agents, and their effectiveness was less than it might otherwise have been.

Fifth, program efforts are evaluated in terms of the appropriateness of their *scale*. In other words, not only the nature, but the extent of the need should be ascertained, and, to the extent possible,

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resources provided accordingly. Some Edison Centers had ascertained breadth of need, and planned the use of their resources accordingly -- others had not. While resources very often do not match need, the first step in gaining sufficient resources is making the case regarding the size of the market for those resources.

Sixth, the extent to which programs are designed to *leverage the use of existing public and private resources* is examined. The concept here, of course, is to conserve program funds by drawing on other resources. Seventh, the appropriateness of *geographic scope* is ascertained. While all Edison Centers have a statewide mission, some focused too narrowly on their immediate regions.

Finally, appropriateness evaluation should seek to assess *how a program measures success*, and if such measurement enhances or inhibits effectiveness. For instance, many Small Business Development Centers are asked to measure effectiveness in terms of numbers of clients served, i.e., outputs, not outcomes. Such an approach encourages quantity, not quality, and is not likely conducive to effectiveness. Program operations are likely to be more effective if they are impact- rather than task-oriented.

## Effectiveness Evaluation

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The primary purpose of effectiveness evaluation is to ascertain the extent to which the technology program actually is hitting the targets at which it is aiming. To the extent possible, effectiveness evaluation seeks to focus on outcomes, with outputs being a second-best alternative (though always useful to measure). The dimensions of outcome evaluation are several, and include:

- ! Business performance -- job creation, job retention, job quality and wages, sales, market share, and profits;
- ! Business operations -- skills and knowledge, products and processes, business practices, linkages with customers and suppliers;

- ! Regional economic impacts -- summation of job creation and retention and wage impacts, including multiplier effects; and

- ! Regional development organization impacts -- capacity development, cooperative efforts.

With regard to the nature and meaning of effectiveness evaluation, several points are in order. First, distinctions among *types of outcomes* must be kept in mind. Some of the above outcomes are fundamental in nature (e.g., regional development impacts); while others are intermediate in nature, that is, provide a platform for positive regional economic impacts (e.g., improvement in worker skills and knowledge, new product development); and other are symbols of economic strength which, it is hoped, result in positive economic impacts (e.g., market share).

Second, outcomes are *moving targets*. Outcomes are open-ended (i.e., can be present a decade from now), cumulative (i.e., build over time, can be discussed in job-years), and volatile (gone yesterday and here today, or vice versa). Measurement methodologies should seek to account for these characteristics.

Third, and most importantly, outcome measurement needs to take into account any *substitution effect*. In instances of economic substitution, clients who receive services from publicly-subsidized technology programs would have purchased such services from private sector resources (e.g., engineering consultants) if the former did not exist. In these cases, public monies are being substituted for private funds, but the outcome remains the same. In other words, when substitution exists, there is no net new impact other than some financial burden being shifted onto taxpayers.

In the Edison evaluation, over 90 percent of Center members reported positive outcomes, along the dimensions described above, as a result of interaction with a Center. However, among members of seven Centers, half said that if the Center did not exist, firm performance, in terms of sales, employment, and profits, would have been the same and would likely be the same in the future. Moreover, the majority of members interviewed in each Center said that if the Center did not exist, they

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would have attempted to seek similar assistance elsewhere. Clearly, then, some substitution exists. At the same time, however, what is unclear is the relative value added by each Center when compared to the alternative -- in terms of dimensions such as quality, time, and links to other firms.

For the Edison evaluation, as for most development program evaluations, the evaluators found no ongoing, in-house means in place for capturing, in specific terms, changes in client firm operations and performance. As a result, impact measurement was retrospective and primarily qualitative in nature. One of the exciting developments in evaluation, as demonstrated by participants in this workshop, is the creation and implementation of effective "real time" means for tracking quantitative changes in firm operations and performance subsequent to assistance. As a result, the information content of effectiveness evaluation is likely to rise significantly, particularly if methodologies can be linked to means for identifying the extent to which economic substitution is present.

## **Organization and Management Evaluation**

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Effectiveness evaluation can indicate the nature and level of outcomes resulting from a technology program. Appropriateness evaluation can explain the extent to which program purpose and structure matched market needs, and so can suggest how outcomes might be increased through changes in purpose and structure. The third leg of the evaluation concerns program organization and management. The aim of this evaluation is to identify the factors that explain levels of appropriateness and effectiveness. It is this part of the work that transforms program evaluation into institutional evaluation. This aspect of the evaluation framework reflects recognition that the design, effectiveness, and operation of individual programs are an extension of the mission, culture, and personnel of the institutions behind them, and that an evaluation of program impacts without an

examination of the institution itself denies evaluators, and program operators, full understanding of the factors behind program effectiveness or lack thereof, and information to identify means to improve effectiveness.

Organization and management evaluation examines the following dimensions of institutional operations:

- ! Management structures (board and committees, operating management, relations with sponsors);
- ! Commitment to understanding true market needs (as opposed to simply following legislative mandate);
- ! Commitment to creating cooperative linkages with other resource providers and development institutions;
- ! Strategic planning;
- ! Client outreach and management;
- ! Client feedback and program adjustment mechanisms;
- ! Human resource management;
- ! Financial management; and
- ! Operating culture.

It should come as no surprise that the Edison evaluation found that the most effective Centers are the ones that are membership-driven in strategy and the design of operations, make proactive efforts to include and meet the needs of a broad constituency, including smaller firms, continually seek market feedback and adjust programs accordingly, and actively build relationships with complementary organizations. It is particularly interesting that the two most effective Centers are based in Cleveland, and operate with active guidance from Cleveland Tomorrow, an organization of regional CEOs that has been a driving force behind the economic revival of that city. In other words, technology programs that answer to an active, demanding, and supportive sponsor have strong encouragement to find paths to effectiveness.

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## Conclusion

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The goal of institutional evaluation is to answer not only "How are we doing?", but also "How can we do better?" The content of specific recommendations is generated from the appropriateness and organization and management evaluations. The former suggests the nature of changes in program design and structure (informed by the economic substitution analysis in the effectiveness evaluation). The latter provides ideas for improvements in the management of processes, services, and people.

In practice, the tripartite approach to evaluation has proven to be a productive tool in guiding development institutions to operating more effective programs. To date, the primary limit on its usefulness has been the lack of ongoing mechanisms for collecting meaningful, detailed, firm-level data prior and subsequent to intervention. The creation and implementation of such mechanisms currently underway suggests the potential for even more productive use of the evaluation framework in the future.