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**Effective Models for Developing Research & Development Programs to Meet  
Organizational Needs**

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***The opinions expressed in this paper represent the viewpoint of the authors and do not necessarily represent the views of New York State Department of Transportation or the University of New York at Albany.***

## **Abstract**

*How do research programs establish their mission, goals, and objectives so that they can respond to existing, anticipated and projected challenges? What criterion is considered in developing strategic plans for these programs? How do these programs build bridges and partnerships with other researchers to strengthen their capacity? What are the advantages and disadvantages? What are effective models of conducting research programs that can yields maximum return on research investments?*

*This paper will analyze how research programs develop their mission. It will assess how programs delivered their services. How did they build bridges to tap into the reservoir of expertise and knowledge yet still maintain a focus on the mission of the organization? How did they manage to bridge the perspective gap between their needs, goals, and mission and those of their partners? What are the advantages and disadvantages of maintaining these partnerships? How did these programs manage to strike a balance that maximize benefits and minimize disadvantages?*

*The product of this paper will be a synthesis of what managers of these programs attest as successful strategies and models that had made possible the conception of enabling programs.*

## **KEY WORDS:**

**SCINCE & TECHNOLOGY POLICY/ PERFORMANCE MEASUREMENTS/ R&D PROGRAM DEVELOPMENT/ STRATEGIC MANAGEMENT.**

## **1. INTRODUCTION:**

*It is often agreed that management of Research & Development (R&D) activities is unique and demands strategies that are tailored to the specific nature of these activities. By its nature, research and development can be risky, its outcome can be unpredictable, and its productivity may be difficult to measure. Yet, research managers are under constant pressure to justify the cost-effectiveness of their programs, and maximize returns on research investments. In times of fiscal constraints, research and development programs become an easy target for budget cuts. It is critical that managers of R&D programs arm themselves with the tools necessary to strengthen conduct of their programs and defend its existence.*

*What are the best practices for R&D management used by others? What are the most common challenges experienced by R&D programs? What strategies do successful programs use to maintain dynamism and flexibility continue to reinvent their programs, and to adapt to changes in the external environment?*

*This paper will examine current R&D program structure used by others, procedures for selecting, conducting and implementing program, guiding principles, vision, goals, objectives, strategic plan, marketing & dissemination strategies, as well as conduct and implementation of research products.*

*This paper analyzes information collected from a review of research literature on R&D management, as well as synthesizes best practices used by R&D organizations, collected from their web sites and other written material. The purpose of this paper is to document best practices used by R&D organizations, and provide promising models for conducting successful R&D programs.*

## **2. ALIGNING VISION, MISSION & OPERATIONAL GOALS WITH PROGRAMATIC INITIATIVES**

*Drafting a vision for R&D must take into consideration the position of the research organization and whether it operates as an independent entity or as an arm of a parent organization. It must also consider its immediate beneficiaries and target clientele. Drafting a successful strategic plan must take an integrated system approach that sees the big picture, the macro prospective without neglecting the micro components of the operations.*

### **2.1 Developing Strategic Plan**

*Strategic plan clarifying the course from the top-down. A strategic plan must be conceived out of an organization mission. It must be closely aligned with the organizational vision. It must be dynamic, not static and updated periodically to reflect changing needs. A strategic plan must consider overhanging issues that affect the organization on a macro as well as a micro level. A strategic plan must be developed by executive management of the organization. For each issue identified by the strategic plan, clear measurable goals and outcomes must be developed.*

Outcome measures must also be developed to specify how the organization will measure its success in achieving its goals. Also, strategies for achieving the goals must be laid out.

“Systems thinking” implies an ability to analyze the external environment and the position of the organization within this environment. Positioning the organization so that it can continue to adapt itself to the changes in the external environment is critical. Strategic planning must be an ongoing and continuous process that allows the organization to stay in tune with the pulse of the environment. Any program development should begin with a strategic plan. The primary focus of the strategic plan is research emphasis areas. This identification of the program focus and direction should be done through feedback from stakeholders. A process must be instituted whereby the organization solicits input from various stakeholders. These stakeholders include any entities that produce or consume the products of research activities. **Appendixes A through E** Provide an example of a research strategic plan.

### **3. MODES OF RESEARCH CONDUCT**

Producers of research include academia, government agencies and laboratories, Private firms, and specialized research organization. Consumers include academia, non profit organizations, government agencies, and the private sector. Producers are also consumers of research, since research starts where others have ended, not from where they began. Consumers of research may contract out their research needs, or they may choose to sponsor its conduct in house. There are several pros and cons associated with these two models of research conduct which will be examined in details in the next section.

#### **3.1 Model 1: Contracting out Research & Development: Advantages & Disadvantages.**

Research & Development can provide access to specialized knowledge, expertise, and equipment available elsewhere. For an organization that has no access to research, contracting out becomes an opportunity to have that access. The disadvantage of such arrangement is the fact that the producer and consumer may have different interest.

Outside contracts may have different agendas and may be driven by a different mission than the consumers of research governmental & non- Governmental organizations are usually motivated by maximizing the public good. Profit is not on their agenda. A private producer of research may have profit as a primary motivation and or the need to conduct theoretical basic research that is of little applied value.

To an academic researcher for example, a measure of a successful research effort is not how valuable its results would be to the world of practice, but how valuable other peers feel that knowledge has been advanced. A direct consequence of having incompatible goals is that research performed may not be directly implemented. The final product may not be turn key but would require extensive effort to prepare it for implementation.

*A common problem with contract research is the inability to maintain adequate control at the project level. Timely detection of deviation from work plans and the need for adjustments to avoid backtracking can be a greater problem. Corrective measures to avoid time slippages can be hard to enforce. Delays in project completion and implementation of research products are often adverse consequences. These problems can seriously obstruct progress and curtail effectiveness. (Burke, 1984).*

*Another constraint that may result in wasted research funds and wasted time and energy is the cultural difference between the two entities involved in the research effort. The contracted entity may fail to understand the culture of the organization for which it is doing the research. It may fall into the trap of "institutional arrogance" and adopt the attitude of "we know what they want, but we will give them what they need". There is a danger in such a situation. Arrogance interferes with understanding problems and designing successful solutions.*

### **3.2 Model 2: Conducting Research In-House.**

*Having researchers who possess the education, experience and training necessary to effectively conduct an in-house program provides a level of flexibility that is hard to duplicate, by having trouble shooting resource on hand to be used on an as-needed basis, and responding swiftly to urgent problems; Harder concurs "Full-time people provide continuity and develop networks that are particularly important for technical assistance and implementation. (Harder, 1991)*

*In-house researchers share a common vision, mission and goals with the clients they serve. They share the same organizational culture. By virtue of being staff members rather than contractors, they are often better equipped to understand the problem and respond effectively to these problems than outside researchers. In-house researchers are familiar with the operating environment, and have first-hand experience in what will, and what will not work within this environment. "The agency needs a sound technical understanding of the specific working culture in which R&D products is to be received and assimilated." (Bacchus, 1992, C64)*

*Research performed in-house has a higher probability of being implemented for the simple reason that the main goal that motivates those researchers is addressing their problems. This is the measure of their success. "In-house makes quick turn/around, and provides staff for implementation/support" (Walker, 100)*

*In-house researchers provide crucial resource for evaluating contract research, and enforcing accountability at the contract level. Research administration, research coordination and contract management, are crucial functions that can be effectively executed by experienced researchers trained in research conduct. In short, relying on in-house research: avoid monitoring problems associated with contracting out research, the strategy provides an important spillover benefit for the agency. It provides the agency with a cadre of scientists who can evaluate outside proposals and inform the agency about research opportunities. "(Cohen, Fielding, Nolan and Smith, 1994, 22).*

Moreover, in-house researchers provide a systematic combat to institutional arrogance, and harness tendencies for ivory tower research. In fact, internal researchers are primarily technology pullers. Technology transfer is an essential function of in-house researchers who continuously scan technological development and facilitate introduction of relevant technology. Those “boundary-spanning technological gatekeepers are better information scouts because they tend to belong to the right networks, whereas generalized scanning service, per se, can tap only standardize channels” (Bacchus, 1992, C64)

Technology transfer leverage research funds, by adapting and adopting ready-made technology rather than unnecessarily duplicating its development. Technology transfer enables the department to “do more with less”

In-house researchers serve as advocates for implementation, guiding the journey from theory to practice. They provide the missing link between research conduct and implementation. “The successful transfer of technology requires first and foremost the realization that good technology will not sell itself. Rather it requires a strategy as well thought out and implemented as the development of the technology itself” (Wolf, 1989, 9). “Developers of the strategy must possess an understanding of the users’ needs and their operating environment. The transfer must be done with full participation of the users. Followup must be made to determine effectiveness of the transfer process. Never say goodbye and good luck. Feed back is an essential for fixing immediate problems as well as for making the next round of technology” (Wolf, 1989, 9).

Cohen, Fielding, Nolan, and Smith suggest that agencies that retain in-house scientists do so because “the quality of scientific advice that (agencies) get for employees on a range of topics would not be available if they did not provide the scientists with opportunities to conduct research as well review and evaluate research done elsewhere. (Cohen, Fielding, Nolan, and Smith, 1994, 23)

However, Research expertise is hard to recruit and retain. The development of a competent research staff involves a long lead time, because researchers are hard to recruit.

In-house program involves staffing/operating cost. Turnover rate is usually high which can be particularly damaging to the research program. Loss of principals from research in progress can cause serious dislocation. (Burke, 1984) Lengthy process for hiring approval makes replenishing resources a challenge.

### **3.3 Model 3: Combining In-House & Contract Research.**

Practitioner experience suggests that combining in house and contract research reaps benefits of both worlds. It helps a program respond to both long term and short term needs, and create conditions pertinent to capitalizing on the benefits and avoiding the pitfalls. Evidence suggests that a combination between those two models is most desirable and can enable an organization to make the best of both models. **Table 1** summarizes the pros and cons for each model.

## **4. DEVELOPMENT OF RESEARCH & DEVELOPMENT PROGRAM**

### **4.1 Developing the Program as Bottom-Up Effort:**

*Following the development of a strategic plan, is the development of the program which must take into consideration two issues:*

*First; it must involve each member of the organization. Solicitation research needs must reach out to the grassroots of the organization.*

*Second; in developing a research program, there must be an integrated system approach to research (Griffith 1995), that grasp the whole system and generate a “Critical Mass” of research, rather than piecemeal projects (Harder 1995). The best approach in developing research program is to start with a wide solicitation process, followed by a review, prioritization process by a committee representing all members of the research constituency. The program should balance topics; risks anticipated future needs, immediate needs identified in the strategic plan. Depending on the size of the agency, its mission and its position in the overall environment, the process of program development takes shape. Experience suggests that the involvement of as many stakeholders as possible in the process of program development is a critical element of program effectiveness. If the research organization serves as a research arm for a large organization, program development must be implemented through a top-down and bottom-up approach.*

### **4.2 Development of R&D Program through a Top-Down, Bottom-Up Process.**

*In this model, several entities are formed to assist the research agency in the process of program development.*

#### **4.2.1 Executives Committee (EC)**

*The Executive Committee will consist of several executive managers. The Committee will provide policy guidance by identifying research emphasis areas, approve major program activities and formulate budget and expenditure plans.*

#### **4.2.2 Research & Development Committee (RDC)**

*This Committee will consist of several mid-level managers from each of the functional areas within the organization. Emphasis will be placed on establishing a well balanced Committee whose members will truly voice grassroots needs and foster a greater coordination and cooperation between different entities within the organization. The Committee’s function will be to identify and prioritize strategic needs of the organization and formulate the annual R&D program.*

#### **4.2.3 Technical Research Teams (TRT)**



*Members of these teams will be appointed by RDC. These teams will be responsible for providing technical input such as development of project problem statements and scope of services for proposed projects. Each team will be responsible for one of the emphasis areas which will be identified by the Executive Committee.*

*These individuals will be designated based on an expertise directly relevant to the research proposed. Members are expected to serve throughout the life of the research, and will participate in the implementation of research results. Number of members in each team will vary depending on demand.*

## **5. PROGRAMMING PROCESS**

*This section sets forth the detailed programming process and operational procedures for the program using the top-down, bottom-up approach.*

*1. Identification and prioritization of research needs: Executive Committee develops a memorandum of understanding (MOU) to highlight research emphasis areas i.e. high priority areas. The MOU will serve as a primary criterion for project selection.*

*2. Inventory research needs: Research staff solicits research suggestions from the different program area within the organization, industry, academia, and surveys strategic research needs from the R&D Committee. This is done through individual and collective brainstorming, i.e. Committee complete survey forms and meets to discuss further research needs.*

*3. Screen research suggestions: Members of the Technical Research Teams are designated. In coordination with designated Technical Research Teams. The research staff conducts initial screening of research suggestions which includes conduct of literature reviews to rule out duplication, classification of candidate problems, and development of first stage problem statements for potential projects. Research suggestions are screened to determine; (a) If the problem is important to the organization (Problems are evaluated against emphasis areas established); (b) If the problem is researchable; (c) If the contemplated research is timely; (d) If successful research will produce significant benefits; (e) If the probability of success of the proposed study is sufficiently high; and (f) If the proposed study can be designed to avoid undesirable duplication of other completed or ongoing research.*

*4. Formulation of tentative research program and spending plan: Candidate research suggestions are submitted to R&D Committee for consideration in formulating the program. RDC rates and ranks problems. R&D Committee members vote to select priority research projects needs, and recommend a consolidated program agenda to the Executive Committee.*

*5. Formulate spending plan and approve tentative program: Executive Committee formulates overall annual spending plan and approves tentative agenda for each program area.*

## **6. EVALUATION AND MEASURING PERFORMANCE.**

*Although R&D programs differ significantly in size, type, focus, direction, and nature of operations, they all share a common mission. They are created to help attain the broader mission of the parent organization. They all share a conviction that quality research program is determined by the ability to meet short and long term organizational research needs in a timely, efficient and effective manner. The key to attaining this objective is a strong management system that strives to achieve maximum utilization of staff and funds. This management system must balance customer satisfaction with the pursuit of R&D objectives, measuring of return on investments, and effective application of scientific inquiry. This entails conformance with standards, costs, and productivity.*

*Research organization is using different methods to measure benefits of their programs, including quantitative and qualitative techniques. The performance evaluation methodology suggested herein is based on the assessment of management system's objectives and intermediate targets, and is tailored to the nature of research programs and is input, rather than output driven. The assessment technique monitors progress toward objectives. Assessment of the management system's performance is made through the examination of a set of indicators that account for various aspects of the system. Those indicators measure the extent of target achievement.*

### **6.1 The Assessment Methodology.**

*The assessment methodology is composed of five steps which together form a cyclical process. Those steps are:*

#### **Step 1: Examine Management System's Objectives**

*Management system's objectives are desired program values and priorities set out to be achieved in the vision. Objectives chart the direction of the program by establishing a clear path to program expectations. Objectives must not be static, but must be change as priorities shift. Objectives are standards which ideally encompass two management elements: process efficiency and outcome effectiveness. Efficiency relates to process management, while effectiveness relates to product management. Operational efficiency is internally-focused, and outcome effectiveness is externally-focused.*

*Developing objectives or efficiency and effectiveness entails establishing a set of targets, which fulfill the same criteria as the main objective.*

#### **Step 2: Establish Performance Indicators**

*Objectives are translated into performance measures which establish specific measurable indicators of program efficiency and effectiveness. Measuring up to these indicators will mean fulfilling program expectations. In other words, management system's objectives are expressed*

as a set of indicators to facilitate measurement. Indicators are units of measures used to express the degree to which targets are being achieved. Targets should strive to bring about technical change in one or more of the parent organization's operations through applications of R&D products.

### **Step 3: Collect/ Analyze/ Interpret Data**

Sources of data are program records as well as direct observation and customer/ employee surveys. When data is gathered, actual performance levels are measured against targets.

### **Step 4: Make Diagnosis**

In this step, conclusions are drawn regarding overall performance of the management system. Diagnosis of performance should include the identification of strength and gap areas. Gap analysis should result in development of alternative corrective actions, and recommendation of the most suitable corrective strategy.

### **Step 5: Communicate Findings**

Reports of findings should be communicated to all stakeholders.

## **6.2. Applying the Methodology.**

Performance evaluation will examine what the program is intended to accomplish, who the targeted recipients are, what the values/ priorities that the R&D unit strives to achieve, what the program delivery standards/expectations are, and how actual delivery measures up to standards set by the R&D unit or commonly adopted by the research community.

Assuming that management system's performance objectives are operational efficiency and outcome effectiveness, the initial challenge is to examine and/or establish milestones for these two targets. Those targets would then be translated into measurable indicators. Data gathered will be analyzed. Using indicators, performance will be measured against milestones.

### **6.2.1 Assessing Operational Efficiency.**

Assessing operational efficiency involves the use of data obtained mainly from program records and employee surveys to examine the day-to-day delivery of the program. Performance evaluation will examine and analyze the operating design element of the management system and its interaction with program inputs. The review will operate on the premise that amount done or workload is secondary, what matter is performance and results.

Process targets will be derived from program mission. **Table 1** provides examples of typical indicators of operational efficiency. Each of these indicators represents a criterion for performance. Each would include a family of measures that specify the standards that the program must strive to reach, so as to achieve its intended expectations. Operational efficiency data sources are mainly procedural program records that document the administration of the program and mobilization of its financial and human resources, as well as employee surveys. **Table 2** provides data sources for assessing operational efficiency.

Performance measures facilitate assessing degree of target achievement, through comparing plan versus reality, and achievement versus objectives. Indicators work together, each a patch in a quilt of measures. **Table 3** provides performance indicators for operational efficiency. When data gathering and analysis is completed, the management will be able to answer the questions: does the delivery system work as intended? Does the organizational climate facilitate efficient delivery?

### **6.2.2 Review of Outcome Effectiveness.**

Unlike operational efficiency which is internally focused, outcome effectiveness is externally-oriented. It focuses on the examination of two dimensions: customer results, and customer satisfaction. **Table 4** provides indicators of outcome effectiveness. **Table 5** provides data sources for assessing outcome effectiveness. **Table 6** provides typical performance measures for assessing outcome effectiveness.

## **7. CONCLUSION**

A well-designed well implemented program of research & development program will strengthen the ability of organizations to meet future challenges. Periodic and consistent evaluation of the program will identify any existing or potential gaps and allow the implementation of mitigative measures. Efficient program design and implementation will accomplish the following:

- \* Research products will be achieved and transferred within schedule and within budget.
- \* Research funds will be allocated based on a long-term strategic plan which anticipates, rather than reacts to problems.
- \* Researchers will be motivated. Turnover will be eliminated or reduced and the organization will be able to retain its intellectual capital and expertise.
- \* Research mission, goals and objectives will be clearly defined.

- \* *Process for program implementation will be outcome-oriented.*
- \* *Investment decisions will be based on customer input and will be as effective and as efficient as possible.*
- \* *Resources will reflect priorities.*
- \* *Researchers training will be linked with mission rather than implemented for its own sake.*
- \* *Maintaining a performance barometer will enable employees to anticipated pitfalls and make mid-course corrections.*
- \* *Customers will become partners and active participants in driving research and development.*

*In conclusion, this guideline above enables research managers to develop, test and evaluate the resiliency and strength of their existing research & development programs. Of course, a particular technique will not be effective for all organizations at all times. However, some of the elements, techniques and strategies discussed here could benefit all research organizations no matter the size, type, available technology, staff capabilities, research facilities, and degree of access to different funding sources.*

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**Table 1- CONTRACT AND IN-HOUSE PROGRAMS: PROS AND CONS**

CONTRACT RESEARCH		IIN-HOUSE RESEARCH	
ADVATAGES	DISADVANTAGES	ADVANTAGES	DISADVANTAGES
<p><b>* An innovation resource</b> Access to specialized knowledge, expertise, and equipment available within the university environment.</p> <p><b>* An arrangement of convenience</b> Mutually-beneficial arrangements</p> <p><b>* Competitive environment breeds effectiveness</b> Competitive methods by which research is solicited strengthen products</p>	<p><b>* Different interests</b> Organization(s) serve public interest, academia serves private interests. Goals do not coincide.</p> <p><b>* Unrestrained tendency for ivory tower research.</b> Organizations need to conduct practical applied research that can be implemented. Academia researchers seek basic theoretical research whose products are perceived to advance knowledge.</p> <p><b>* Turnkey products are an unfulfilled quest</b> Lack of familiarity with the world of practice leads to conception of theoretical products that need extensive organization efforts to bridge the gap to practice.</p> <p><b>* Stumbling blocks to responsiveness</b> Considerable time vested before project initiation, and long project completion time due to turnover and poor student continuity make contract program non responsive to immediate urgent needs.</p> <p><b>* The critical need for a watchful eye</b> Inability to maintain control at the project level.</p> <p><b>* Institutional arrogance</b> ΔWe know what they want, but we will give them what they need@ attitude leads to underestimating complexity of the problem, over-promising and under delivering.</p> <p><b>* Misconception of an ultimate one stops shopping station.</b> Contract research cannot accommodate all research needs. It is not responsive to urgent time -sensitive, immediate needs.</p>	<p><b>* A reserve of troubleshooters, first response team of experts</b> In-house researchers provide continuity, and flexibility that is hard to duplicate.</p> <p><b>* Insiders possess deeper understanding of problems</b> In-house researchers share common vision and mission with the clients they serve. They have deeper understanding of problems faced, and respond more effectively to them.</p> <p><b>* Internal research has a higher probability of implementation</b></p> <p><b>* Internal researchers are regulators of technology development.</b> Provide resource for needs identification, screening of literature to determine research viability, coordinating research, and managing research in progress, combating institutional arrogance, harnessing tendencies for ivory tower research, and enforcing accountability at the contract level.</p> <p><b>* Internal researchers are facilitators of technology Pull.</b> As technology transfer agents, they enable the organization to do more with less.</p> <p><b>* Internal researchers are advocates for technology Push.</b> Keep a bias for implementation.</p> <p><b>* An active researcher offers quality scientific advice.</b></p>	<p><b>*Research expertise is hard to recruit and retain</b></p> <p><b>* The development of competent research staff involves a long lead time.</b></p> <p><b>* Staffing and operating costs</b></p> <p><b>* High turnover rates.</b></p>



**APPENDIX A  
STRENGTHEN R&D ROLE WITHIN THE ORGANIZATION**

GOAL	OBJECTIVES	OUTCOMES	OUTCOME MEASURES	STRATEGIES
<p>1. Maintain a mission mentality.</p>	<ul style="list-style-type: none"> <li>Ž Become a recognized resource for management.</li> <li>Ž Provide developing technology for management policy decisions.</li> <li>Ž Develop organization R&amp;D resources to influence its direction.</li> <li>Ž Promote a learning environment, and increase in basic knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Dynamic program that addresses developing R&amp;D.</li> <li>Ž Vital resource for R&amp;D.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Research program involvement in policy decisions.</li> <li>Ž Use of R&amp;D resources.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Actively pursue developing technology.</li> </ul>
<p>2. Refine research management process.</p>	<ul style="list-style-type: none"> <li>Ž Establish and maintain dynamic research management processes;</li> <li>Ž Ensure that research is conducted and implemented effectively.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Current procedural manual.</li> <li>Ž Operational process manual;</li> <li>Ž Implementation and tracking processes.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Implementation of applicable results;</li> <li>Ž Organization-wide adherence to procedural guidelines.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Update and maintain procedural manual;</li> <li>Ž Develop operational procedure manual.</li> </ul>
<p>3. Establish direction for R&amp;D.</p>	<ul style="list-style-type: none"> <li>Ž Broaden program beyond existing parameters;</li> <li>Ž Promote research that can be implemented;</li> <li>Ž Ensure that research program is consistent with organization's mission;</li> <li>Ž Encourage organization-wide R&amp;D effort.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Expanded well-rounded RD&amp;T program.</li> <li>Ž Organization-wide application of R&amp;D.</li> <li>Ž Useful research.</li> <li>Ž Needs-based R&amp;D.</li> </ul>	<ul style="list-style-type: none"> <li>Ž R&amp;D addressing a wide range of issues.</li> <li>Ž Percentage of R&amp;D results implemented.</li> <li>Ž Organization use of R&amp;D for guidelines and solutions.</li> </ul>	<ul style="list-style-type: none"> <li>Ž Aggressively pursue Organization-wide participation;</li> <li>Ž Conduct research with potentially applicable results;</li> <li>Ž Cooperatively establish goals with different players and stakeholders.</li> </ul>

**APPENDIX B  
PROMOTE RECOGNITION  
THE VALUE OF RESEARCH**

OF

**Goal:** ? Promote recognition of research value within the organization.

**Objectives:** ? Improve staff perception of research program.  
? Increase credibility of the research within the organization.  
? Maintain senior management support for research.  
? Effectively use available funds.

**Outcomes:** ? Credible program.  
? Senior management support.  
? Improve organization image.  
? Research used as resource to accomplish mission.  
? Positive research attitudes.  
? Expanded research funding.  
? Recognition of benefits and advantages of the program.  
? Timely response to management.

**Outcome**

**Measures ?** Percent of funding increased.  
? Number of funding sources increased.  
? Number of opportunities to share information about research program.  
? Organization use of program.  
? Number of management directives implemented.

**Strategies ?** Publicize research's value to accomplish organization's mission.  
? Share success stories.  
? Ensure research is conducted in a timely manner.  
? Publicize research program to increase staff awareness.  
? Network research program nationally.  
? Pursue all available funding sources.  
? Implement effective management process.

**APPENDIX C  
MAINTAIN RESPONSIVENESS AND PRO-ACTIVITY**

OBJECTIVE	OBJECTIVES	OUTCOMES	OUTCOME MEASURES	STRATEGIES
<p>Support a well balanced needs-driven R&amp;D program</p>	<ul style="list-style-type: none"> <li>• Promote customer ownership through committee structure;</li> <li>• Broaden pool of research customers;</li> <li>• Institute interactive needs identification mechanism where every organizational member has a voice.</li> </ul>	<ul style="list-style-type: none"> <li>• A well-rounded multi-modal needs-driven research program;</li> <li>• Diversified research;</li> <li>• Implementation of research results;</li> <li>• Identification of customer research needs;</li> <li>• Increased research suggestion submissions.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of research suggestions submitted;</li> <li>• Diversity of research suggestions</li> </ul>	<ul style="list-style-type: none"> <li>• Actively solicit research suggestions.</li> <li>• Survey executives for emphasis areas;</li> <li>• Conduct brainstorming sessions to identify needs.</li> <li>• Publish newsletters.</li> <li>• Solicit external experts and perspective on research issues.</li> </ul>
<p>Establish customer-oriented R&amp;D program</p>	<ul style="list-style-type: none"> <li>• Provide timely solutions</li> <li>• Implement and track research outcomes;</li> <li>• Provide a system to effectively collect and respond to research suggestions;</li> <li>• Take advantage of available R&amp;D resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Customer satisfaction;</li> <li>• Organization research needs met;</li> <li>• Maximize use of available R&amp;D resources</li> <li>• Responsive, credible program;</li> <li>• Customer use of program</li> <li>• Increase in results implemented.</li> <li>• Effective use of available funds;</li> <li>• Use of innovative technology.</li> </ul>	<ul style="list-style-type: none"> <li>• Number of implemented results;</li> <li>• Positive benefit/cost ratio</li> <li>• Cost savings</li> <li>• Customer recommendations</li> <li>• Research library use</li> <li>• Number of inquiries, consultation, technical assistance, and technology transfer.</li> </ul>	<ul style="list-style-type: none"> <li>• Establish process for employee involvement;</li> <li>• Establish implementation and tracking process;</li> <li>• Network with external organizations and agencies;</li> <li>• Review and evaluate products of national and regional research efforts.</li> <li>• Operate research library;</li> </ul>

**GOAL:** *Ž Develop interactive organizational structure for R&D.*

**ORGANIZATIONAL STRUCTURE**

**OBJECTIVES** *Ž structure for research administration/ coordination;  
Ž Establish structure for research & development;  
Ž Establish structure for technology transfer;  
Ž Establish structure for implementation.*

**OUTCOME**

**MEASURES:** *Ž Number of on-going projects;  
Ž Number of projects under contract;  
Ž Number of implementation initiatives;  
Ž Number of technology transfer initiatives;  
Ž Number of consultations and technical assistance;  
Ž Degree of participation in national research programs.*

**OUTCOMES:** *Ž Organization coordination of R&D.  
Ž Strong research management process.  
Ž Effective resource use.  
Ž Expanded R&D program.  
Ž Coordination with national and regional R&D initiatives.*

**STRATEGIES:** *Ž Clarify R&D functions.  
Ž Clarify individual staff functions;  
Ž Communicate with all players and stakeholders involved.  
Ž Work with senior management to allocate staff.*

**APPENDIX E**  
**PROMOTE INTERNAL AND EXTERNAL INFORMATION EXCHANGE**

**GOAL:** *Provide mechanisms to share R&D information.*

**OBJECTIVES:**

- Expedite sharing of research ideas, implementation, and results.*
- Strengthen cross-functional network for information exchange.*
- Establish network with external organizations.*

**OUTCOMES:**

- Maximum return on research investments.*
- R&D recognized as a resource.*
- Well rounded R&D program.*
- Informed decision-making.*
- Informed staff.*
- Enhanced staff productivity.*

**OUTCOME MEASURE:**

- Involved staff.*
- Staff awareness.*
- Outreach to other organizations and programs.*
- Number of R&D collaborations.*

**STRATEGIES**

- Provide R&D library.*
- Strengthen R&D staff as implementation resources.*
- Establish Technology Transfer initiatives for sharing and transfer of information.*
- Disseminate R&D information using newsletters, web site, and on-line database.*

**TABLE 2- INDICATORS OF OPERATIONAL EFFICIENCY**

<p><b>Deploy an Efficient Administrative Framework.</b></p> <ul style="list-style-type: none"><li>- Implement comprehensive total quality management.</li><li>- Maintain focus on production timeliness, cost-adherence, and product accomplishments.</li></ul>
<p><b>Maintain Sound Fiscal Responsibility.</b></p> <ul style="list-style-type: none"><li>- Systematically chase waste.</li><li>- Invest strategically.</li></ul>
<p><b>Maintain an Empowering Organizational Climate.</b></p> <ul style="list-style-type: none"><li>- Deploy multi-skilled balanced team players.</li><li>- Institute a systematic learning process.</li><li>- Maintain employee motivation.</li></ul>

**TABLE 3- DATA SOURCES FOR ASSESSING OPERATIONAL EFFICIENCY**

<p><b>Operational Efficiency Data Sources.</b></p> <ul style="list-style-type: none"><li>- System for identifying needs.</li><li>- System for determining priorities.</li><li>- Management control system that follows progress, cost, and reporting requirements.</li><li>- Mechanism for management of contracts to avoid overruns in scheduling and budgeting.</li><li>- Mechanism for disseminating program outputs.</li><li>- Employee surveys.</li></ul>
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**TABLE 4- PERFORMANCE INDICATORS FOR OPERATIONAL EFFICIENCY**

<p><b>Administrative Framework.</b></p> <ul style="list-style-type: none"><li>- Degree to which administrative procedures systematically track progress, milestones, cost and reporting requirements.</li><li>- Production timeliness and task completion.</li><li>- Degree of accuracy and completeness of record keeping for program output.</li><li>- Degree of alignment of procedures with mission in a logical pathwa y.</li><li>- Proper management of contracts to avoid overruns in scheduling and budgeting.</li></ul>
<p><b>Fiscal Responsibility.</b></p> <ul style="list-style-type: none"><li>- Reasonableness of budget estimates.</li><li>- Extent to which program fund allocation is consistent with strategic planning.</li><li>- Fiscal commitment to research funding.</li></ul>
<p><b>Organizational Climate.</b></p> <ul style="list-style-type: none"><li>- Deploy multi-skilled team players.</li><li>- Extent of consistency of role definition with actual roles.</li><li>- Degree to which staff is consistent in size, expertise with mission.</li><li>- Extent to which staff maintain coordination/communication.</li><li>- Degree of employee understanding of expectations.</li></ul> <p><b>Institute a Systematic learning Process.</b></p> <ul style="list-style-type: none"><li>- Degree of access to skill development resources, technology and information.</li><li>- Adequate interactive learning through close contact with the scientific community.</li><li>- Comprehensiveness of training and continuous education endeavors for each level of employee.</li></ul> <p><b>Maintain Employee Satisfaction/ Motivation.</b></p> <ul style="list-style-type: none"><li>- Degree of internal cohesiveness in staff functions.</li><li>- Extent to which organizational culture promotes team spirit and boosts employee morale.</li><li>- Degree to which management communicates rather than dictates.</li><li>- Adequate reward system for high producers.</li><li>- Extent to which staff feels that what they do day-to-day advance the mission.</li><li>- Extent to which employees feel that their efforts matter and their progress measured.</li><li>- Proper linking of individual goals to organizational goals.</li><li>- Commitment of top management to research functions.</li><li>- Inclusion of research functions in organizational vision statements, budget.</li><li>- Adequate participatory management practices, i.e., involvement of staff in decision-making.</li></ul>

**TABLE 5- INDICATORS OF OUTCOME EFFECTIVENESS**

<p><b>Customer Results.</b> - Maintain a mission mentality. - Focus on value contribution.</p>
<p><b>Customers Satisfaction.</b> - Maintain responsiveness and pro-activeness. - Institutionalize collaboration through cross-functional integration. - Allow flexibility for high priority problem-solving. - Deploy a network mechanism that incorporate perception of users. - Maintain reliability, and assurance.</p>

**TABLE 6- DATA SOURCES FOR OUTCOME EFFECTIVENESS**

<ul style="list-style-type: none"><li>- System for evaluation to determine objective achievement of the R&amp;D program.</li><li>- Methods for determining potential projects' values.</li><li>- Methodologies for prioritizing needs.</li><li>- Methods for monitoring research-in-progress performance.</li><li>- Methods for evaluating project outputs.</li><li>- System for obtaining feedback from customers.</li><li>- Strategic direction setting mechanism that charts program course, formulates strategies, and translates strategies into implemented actions.</li><li>- Customer surveys.</li></ul>
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**TABLE 7- PERFORMANCE MEASURES FOR OUTCOME EFFECTIVENESS**

**Customer Satisfaction Responsiveness/ Pro-Activeness.**

- Degree of utilization of a collaborative interactive process of program identification, prioritization, and formulation, that assures customer orientation.
- Degree of flexibility of process to allow addressing short-term needs high priority problem solving and project modification.
- Systematic adapting of process to adjust to changing needs.
- Extent to which program contribute to advancing the strategic positioning of the organization.
  
- Percent of of satisfied customer.

**Reliability/ Assurance.**

- Response time to high priority, urgent needs.
- Accuracy in implementation.
- Timeliness in delivering products.
- Timeliness of conduct/analysis/and follows up on user survey.
- Average time of processing customer research suggestions/requests.

**Customer Results.**

*a. Mission Mentality.*

- Clearly define mission statement, measurable goals/objectives.
- Alignment of mission with organizational resources.
- Wide understanding of mission by staff members.
- Consistency of staff activities with stated goals and objectives.

*b. Value Contribution.*

- Extent of relevance of program development methodologies to needs, characteristics and goals.
- Extent to which program development methodologies are outcome-based.
- Merit of methods by which potential projects value is determined.
- Scientific merit of output evaluation methodology.
- Systematic involvement of appropriate project personnel throughout the phases of the project.
- Extent to which performance monitoring system clearly indicates degree of objective achievement, and facilities deployment of corrective measures, including objective modification.
- Degree of aggressive implementation of product marketing and adoption strategies.

