

MANAGING AN I/UCRC:

Control, Budgeting and Evaluation

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C H A P T E R
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Effective management may be similar to a naval metaphor: Set the proper course and steer to it. Of course, even a brilliant navigator needs a compass to stay on course. Put into language more fitting to an MBA program: Well run organizations require both appropriate goals and techniques, like the navigator's compass, to ensure that those goals are being met. Those techniques include the control systems we will discuss in this chapter.

Goals give a center a sense of direction and encourage staff and IAB members to communicate about critical issues. However, centers work with multiple and sometimes conflicting stakeholders and in very dynamic environments. A center with goals, but no mechanism for judging progress toward attaining those goals, will quickly find itself adrift, perhaps inviting mutiny by its most important stakeholders—its members.

This chapter provides this mechanism. It discusses tools, techniques, and methodologies such as controls, budgets, evaluations, and some best practice to monitor and ensure progress toward goals. In doing so, we will try to emphasize a pragmatic strategy which meets the needs of small as well as large centers, and recognizes that while control and feedback mechanisms are essential to success, an obsession with formal controls and controlling can drain scarce resources and stifle creativity.

CONTROL

Control is generally defined as regulating organizational activities to achieve levels of performance in conformance with expected standards and objectives. In more common language, controls are means by which we head toward an objective; they keep us from veering off in undesirable directions and help to prevent unwanted outcomes.

In the scientific and engineering world the concept of control is closely identified with feedback. Similarly, the generalized methodology for management control closely resembles an informational feedback loop. Evaluation research also stresses feedback for decision-making.

Control mechanisms serve many purposes in an organization: they help to gather timely information; identify problems, opportunities, and irregularities; cope with uncertainty; and provide credibility for decision making. But even these important purposes do not mandate that every organization have a formal management control system. I/UCRCs, characterized by modest size, multiple clients, and a boundary-spanning operation, present the Director with a wide choice of control mechanisms. For example, talking with IAB members at semi-annual meetings is an opportunity to gather information in a timely fashion and exert *informal control* over the important issue of member satisfaction. Alternatively, the NSF-mandated evaluation protocol (see section titled *Applying Controls for Operational Issues* in this chapter) provides an opportunity for obtaining objective, sometimes anonymous and detailed information from members about center operations and outcomes. The data, in turn, may be incorporated into a *formal, systematic control function* to contact all those who are not "almost certain" that their firms will renew membership to ascertain problems and suggest solutions. Both approaches provide an opportunity for exercising management control. Choosing a formal or informal control strategy is largely dependent upon the variable to be controlled, the resources available, and the personal style of the manager.

There are three types of control systems: at the time of decision (go/no-go control), during project operation (steering control), and at completion (post-action control). Each has a role in an I/UCRC.

Go/no-go control is used whenever prior approval of an action is mandated. For example, the IAB voting the start-up of all new research projects is this type of control.

Steering control ensures that progress is being made and if not, allows corrective actions. For example, a researcher reports to the IAB on progress to date and can solicit advice and suggestions about how best to meet goals and successfully complete the project.

Post-action control determines the success of completed efforts. For example, most centers report end of fiscal year spending patterns. Additionally, in the I/UCRC context, post-action control is an important technique for justifying the center research program to NSF, member firms, other parts of the university. Whether the control is exerted formally or informally, each keeps the center focused toward its mission and objectives.

The primary emphasis of a control strategy must be utility. Control information has value to the extent that it may provide some surprise, causes the decision maker to take action that otherwise would not have been taken, or leads to improved performance. The exception report is such a document. It is prepared only when the variable being controlled deviates far enough from a recognized standard that management needs to be informed and corrective action taken. Control systems which tell you what you already know, provide no impetus for action, and don't lead to improved performance probably are not worth the investment of time and resources.

THE CONTROL MODEL

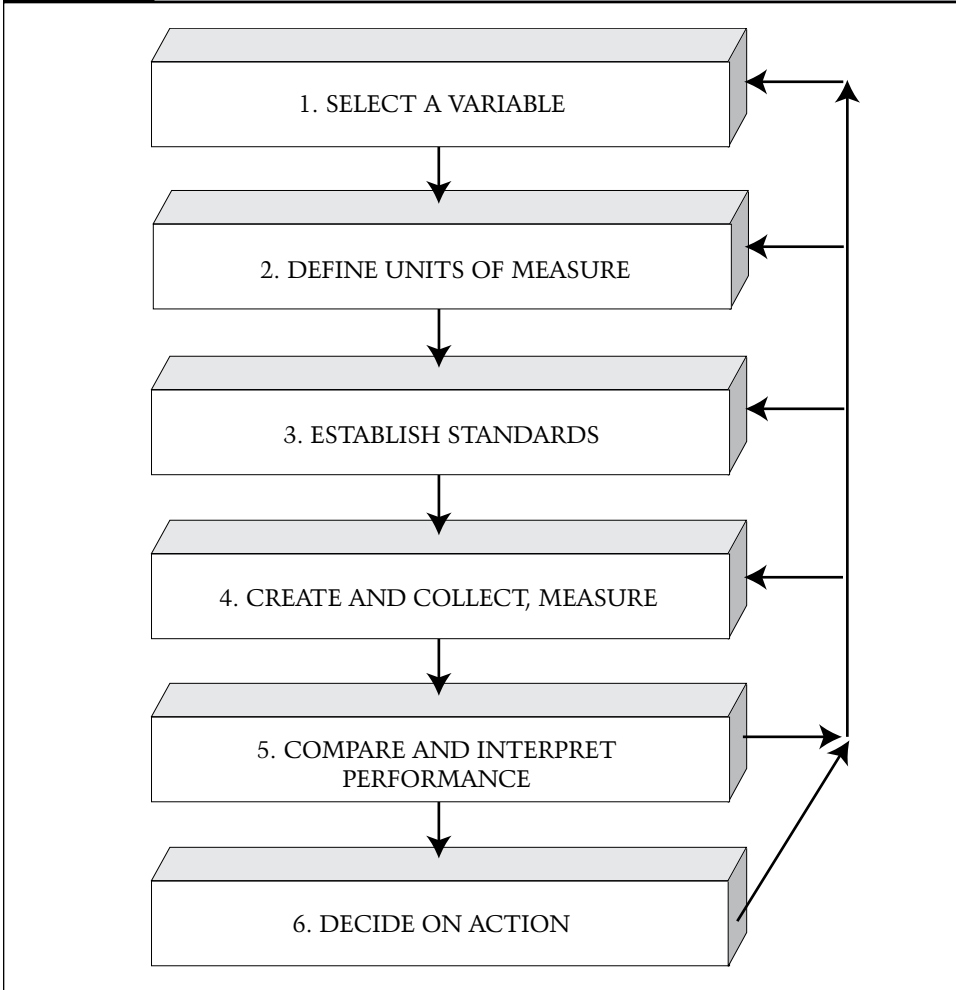
The control process model (see Figure 8-1) is more descriptive than prescriptive. That is, every control opportunity, particularly informal controls, need not follow it to the letter. Rather, awareness of these steps, as well as explicit referral for formal control functions, should help ensure an effective and efficient I/UCRC.

Select the Control Variables

Control is not abstract; it is a concrete task applied to specific organizational variables. For example, an I/UCRC may wish to institute a formal control system for financial resources for both future revenues and expenditure of funds, membership retention and recruitment, and research quantity and quality.

Define the Appropriate Units of Measure

Specificity is the key. While the meaning of high or low is arguable, numbers are not. For example, a year-to-year comparison of

Figure 8-1 The control process.

the number of center members is a specific measure of retention. Recruitment measurements might include the number of new firms contacted, visited, or attending a center function or meeting compared to the number of firms that join the center.

Establish a Performance Standard Based on the Unit of Measurement

Various types of standards have a role to play in center management. One is the floor—sometimes a standard becomes the minimal level of acceptable performance. For example, the National

Science Foundation has established \$300,000 as the minimum industrial support for I/UCRC membership. Another kind of standard is norm-referenced—a standard can be based upon the average performance of all I/UCRCs such as comparing the number of IAB members in each center. During the recession of the early 1990s the average mature center lost members. Any center that stayed even was actually performing at a better than average level. Yet another is the fiat—a standard of measurement might be that the IAB require that no single project account for more than 25 percent of the research budget. The last is the goal or plan—certain levels of performance can be specified in the I/UCRC plan, goal, or in RFPs.

Create and Implement the Measurement Tool(s)

This is the step where control information is collected. Some of that information (e.g., number of members, annual budget) is already in the system; no special tools are required. Information on IAB member satisfaction is much more diffuse and care must be given to ensure the best methods are used to collect it. The NSF evaluator is mandated to collect data and has a battery of tools (see section titled *Control and Evaluation Research* in this chapter). The savvy director needs to ascertain how they fit into the I/UCRC's control system by focusing on the previous steps and what additional information gathering tools are required.

Compare Actual Performance to the Established Standard and Interpret the Results

These comparisons can be mundane. For instance, the standard was to generate three patents and the center received five, or the standard was to sustain all members and two resigned. Much more important is interpretation: Is the discrepancy significant? What caused it? What should be done? Trend analysis of the number of patents awarded per year for the previous five years would demonstrate whether the most recent year's performance was normal, extraordinary, or below par. In general, longitudinal data are much more helpful for interpretation. Determining causes may prove simple (e.g., two members were lost because those companies were merged with companies that were also members) or nearly impossible (e.g., company xyz left and they can't really explain why or what might have been done to keep them). Understanding

the cause is not always necessary, but it always widens the scope of proposed action.

Decide on the Action Required and Follow Through

A control system is deficient if the information provided isn't actionable. One appropriate action may be to do nothing at all (e.g., the performance meets standards). A second action may be to investigate what caused the loss in membership; is it a factor under I/UCRC control or the result of a national recession. A third possible action is revising the standard. Trend analysis shows more patents generated, so the standard is increased. Another option is to revise the control system: introduce a new variable to control, design a more sensitive collection instrument, or alter the time frame in which the system works. Finally, perhaps atypically, is to take the indicated action(s) which will reimpose control over a recalcitrant variable (e.g., fire the administrative assistant who can't seem to keep the center budget in accord with university accounting procedures). The key to action to the entire control process is to understand that it is an ongoing process. It is not a decision that is arrived at only once; it is a repetitive cycle that continues over the life of the center.

Summary

The concept of control is central to the management function and directly complements the planning process. Like most small organizations, information for the control process may be informal reconnaissance or formal information collected as part of a systematic data collection effort (collected before, concurrently or after center operations). Regardless of how control information is collected, it always should be a part of an iterative process which provides a basis for action which can improve a center's performance.

FINANCIAL CONTROL: BUDGET DRIVEN MODEL

As Brinckloe et al. (1977) conclude, finances have the favorable characteristic of being driven by explicit cost and expenditure figures, making them convenient for control. Not surprisingly, this is undoubtedly the aspect of organizational control most of us have firsthand experience with. Following the six step process introduced in the previous section, most of the financial control process can be broken down into two major components: budgeting

(steps 1 to 3: selecting variables, defining units, establishing standards), and accounting (steps 4 and 5: measuring and comparing performance to standard). Where budgeting can be seen as an art that is inextricably linked to organizational planning and involves forecasting, accounting is a science that must obey generally accepted accounting principles. In our coverage, we will emphasize budgeting for two reasons: budgeting is central to all three kinds of control (go/no-go, steering, and post action), whereas accounting is most frequently associated with post-action control; most Center Directors, because of their responsibility for planning, will need to learn the art of budgeting, but can always delegate or purchase the science of accounting.

PRINCIPLES OF BUDGETING

Because budgeting is an art, there is no one, specific model that all managers should follow. There are, however, *four* desiderata of a practical and useful budgeting system:

- Budgets should be comprehensive, objective public documents available to all interested parties; they should account for all aspects of a center's operation and reflect the choices made for competing futures (e.g., projects and approaches).
- Budgets should be based upon measurable units of responsibility that each researcher and center administration prepares, and for which they are responsible.
- Budgets must be flexible, and capable of adjusting to change. Budgets are only based on certain planning assumptions. When those assumptions prove wrong, or totally unexpected information is received, managers must accommodate the new data by reconfiguring their plans as well as their budgets. Center budgets are always in flux (e.g., grants may be in the pipeline, an economic downturn may cause membership to drop) and the wise director and principal investigator (PI) must be able to plan and budget around these contingencies.
- Budgeting systems should include a comprehensive, integrated information and performance reporting system that provides management with timely reports as to progress and significant variances from the plan. When accounting information is added they are the framework for steering control, measuring at suitable intervals, i.e., bi-monthly, how the

plan is actually progressing and taking necessary corrective action.

BUDGETING IN AN I/UCRC

Centers are small organizations in which administration is responsible for preparing a *master budget* that combines all revenues and expenses. In order to accomplish this, the Center Director (or designate):

- Forecasts revenues. This is the most difficult element since recruitment and retention of members and other revenue-generating activities are uncertain.
- Justifies the fixed costs associated with center administration, recruitment and technology-transfer activities. This budget will provide the basis for determining the center's research budget.
- Delegates but not abrogates responsibility to principal investigators to develop and justify operating budgets for research projects. This should include support that is already committed to multi-year projects as well as to new projects.

Information on project budget variances must be available bi-monthly so that the Center Director can utilize the steering control option.

CENTER REVENUE: FUND ACCOUNTS

Unlike most university-sponsored research, a center's revenue budget is neither certain nor simple. The typical center revenue support structure involves multiple sources, often with different overhead rates, which arrive at different times during the year, and with varying certainty. It presents directors with questions about how and when to bill members (see Figure 8-2.) This presents the director with two unique challenges: how to keep various sources of funding with their conflicting structures straight and how to accommodate the uncertainty.

Centers receive support from multiple sources and each source may have different conditions and rules (see Figure 8-3 for a summary of possible differences). Combining all sources of funding into a single account can cause an administrative nightmare for the center and the university (how much overhead should be charged,

Figure 8-2 Billing center members.

It probably doesn't make sense for a center to invoice members for annual dues or enhancement projects. This activity is best left to the university administration, but they should confirm

the billing. Invoices are usually sent out once a year, but most universities will send semi-annual or even quarterly invoices, particularly if a member supports

Figure 8-3 Typical I/UCRC revenue accounts.**NSF/Government Agency**

Predetermined overhead rate. Support budgeted into specific line items. Must meet specific rebudgeting and auditing guidelines. Limits on carrying support forward from year-to-year.

Industrial Memberships

Many Centers provide cost sharing by waiving or reducing their negotiated overhead rate on industry membership fees. Funds are not budgeted to specific line items. Great rebudgeting latitude. Support can be carried forward from one year to next.

Government IAB Members—MIPRs

Memberships from government agencies are usually transferred by NSF to a center via Military Interdepartmental Procurement Request (MIPR). These funds will be charged the same overhead as industrial memberships plus a small NSF handling surcharge.

Government Sponsorship

Federal agencies can sponsor a center via a multi-year grant or contract. Overhead and restrictions will depend upon the nature of the award and the requirements of the specific agency.

State Funding

Overhead rates and restrictions differ from state to state.

Industry Enhancements

Usually project sponsor-specific but may be charged the same overhead rates as industry memberships. Additional conditions may affect timelines, reversion of unspent funds, etc. This may require a separate account for each enhancement.

Contracts

Industrial and government contracts are usually negotiated on a case-by-case basis and may vary in terms of overhead, deliverables, timelines, etc. A separate account for each contract is typical.

which budgeting and rebudgeting rules should be followed, how will special conditions be monitored) and will provide a heyday for an auditor. One useful strategy is establishing separate accounts for specific donors or sources of revenue. To the extent possible, each separate account is earmarked for a specific expense. (See section titled *The Accounting Function* in this chapter.) For instance, all the NSF or government agency money pays for administration,

or XYZ Corporation money pays for lab equipment. Sub-accounts under a master account can fund each faculty project.

There is no simple fix for the revenue uncertainty which goes with running a center. As a consequence, control-wise directors prepare budgets which include a range of projected revenues, probability statements, and critical assumptions. (See Figure 8-4.)

Figure 8-4 Sample I/UCRC estimated revenue budget.

CENTER BALANCE SHEET BUDGET FY1997

SOURCES (in \$k)	Low	Level	High
Memberships	240	300	360
Affiliate Memberships	0	30	30
NSF/Government Funding			
I/UCRC Program	25	25	25
TIE Grants	30	80	100
Other	50	50	150
Governmental Grants			
ARPA	50	80	100
NIH	30	50	80
Other	0	30	50
Governmental Contracts			
EPA	50	80	120
Other	40	60	50
State Funding			
DOT	35	40	60
State I/UCRC	50	50	80
Other	10	10	20
Special Projects			
XYZ Contract	40	40	75
ABC Grant	30	50	60
Other	20	25	50
Total Income	700,000	1,000,000	1,385,000

(Courtesy M. Griscavage, HSMRC, NJIT)

CENTER EXPENSES

Center expenses can be broken down into fixed (typically administration) and variable (research) expenses. Most centers can use expense categories used in federal awards: personnel, fringe benefits, tuition, travel, equipment, computer operations, contractual services, office supplies, research supplies and expenses, and overhead.

Fixed Expenses: Administration

Centers demand a great deal of time and effort for general administration, recruitment and retention activity, and technology transfer to operate efficiently and effectively. At a minimum, fixed administrative expenses will include salaries and fringe benefits for the director (usually via release time, summer salary), an administrative assistant or secretary, an evaluator and a bookkeeper/accountant; equipment needs; general office supplies and copying; and travel support for recruiting, retention, and technology transfer activities. Although most administrative expenses fit within standard budget categories, some do not, such as paying for meals at semi-annual meetings; handling such expenses may require consultation with your grants and contracts office.

Most I/UCRCs have lean administrative budgets, on average 18 percent of their total operating budget. Although there is no perfect formula for deciding upon the administrative budget, it's a mistake to shortchange this aspect of center operations. Centers need an adequate support team, travel, and marketing budgets. Generally speaking, under-budgeting administration costs (particularly recruiting and related expenses), represents a penny wise, pound foolish budgeting strategy.

Research Expenses

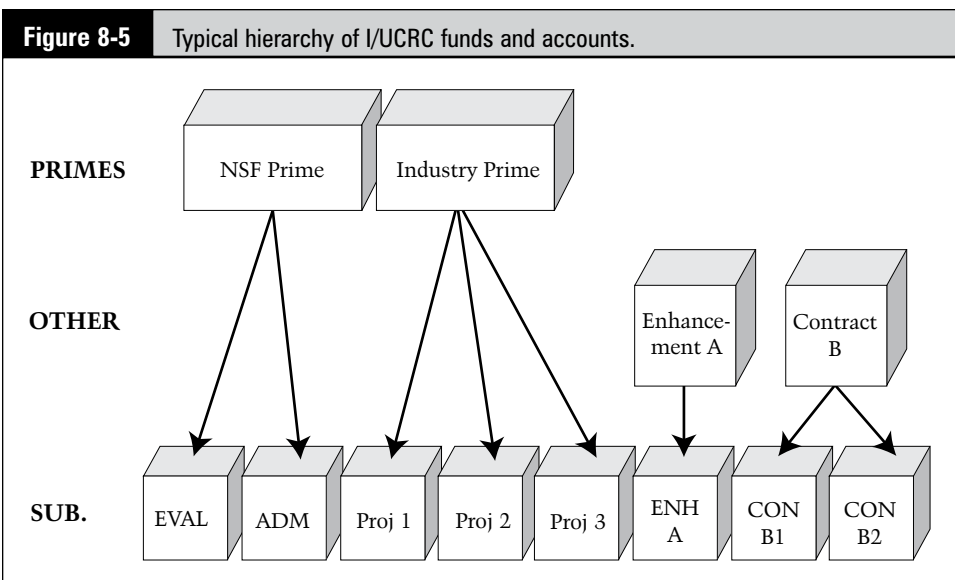
Most important is the research budget. Once the revenue budget and fixed expense budget are completed, calculating the aggregate research budget is pretty straightforward. Research budget = Revenues – Fixed Expenses. However, parts of the research budget are considerably more complicated.

Because principal investigators are responsible for achieving the goals spelled out in their proposal, it is important that each project be considered a separate expense center. The principal investigator is responsible for preparing, defending, managing, and controlling his or her own budget. The most appropriate time to secure the needed budget data is at the proposal stage before funding. Faculty

researchers must submit a complete proposal, with a detailed budget so that the Center Director and IAB members can make an informed choice regarding the proposed research.

The project budget categories should be consistent with the center's and the university accounting guidelines. Although most centers allow faculty considerable discretion in framing their budgets, some centers require faculty to keep their budget requests within certain guidelines. For instance, 10 percent release time; one month summer salary; one graduate student; \$2,000 travel; \$500 supplies. Once approved, then the Center Director and budget administrator negotiate with the faculty researcher a final working budget. These details are posted to the center's master budget.

Ultimately, if you want PIs to operate like they are responsible for an expense center, center awards should look and feel like extramural awards. This goal can be achieved by having the university grants and contracts office establish subaccounts under one or more of the center's prime accounts. Some centers send researchers award letters from the university grants and contracts office or the center. While this can be time consuming, it provides for greater accountability, provides a mechanism for distributing overhead to participating departments, and ensures the principal investigator will get recognition along with the responsibility. Figure 8-5 shows a hypothetical hierarchy of funds for a typical I/UCRC.



To provide the PI adequate tools for budget decision making, it is recommended that, at the time of the budget assignment, any grant-specific controls and restraints be passed directly to the principal investigator(s) from the center administrator. Acknowledgment of any special requirements should be required from the PI for the record. Figure 8-6 shows an example of a memorandum of acknowledgment.

Figure 8-6 Sample memorandum of acknowledgment.

Your FY 1997 operating budget for this fiscal year is attached. There are three areas of concern which you need to be aware of and acknowledge to the Center Director.

- Only equipment specifically listed on your budget (if applicable) may be purchased. Equipment not listed will require prime grantor approval; allow time for written permission to be obtained. Equipment must be purchased no later than 60 days prior to the end date of your project.
- All budget transfers must have prior approval (e-mail, fax requests acceptable). For subcontractors, variances are permitted, as allowed for in the Prime Grant, without request.
- No budget extensions or carry-overs will be allowed.

Subcontract/budget documents are being completed and will be processed through your Office of Sponsored Programs, or equivalent authority. Please sign and return the annotated copy of this letter to the Director by fax or mail as acknowledgment of receipt of this letter. Thank you.

Acknowledged: _____

Project Number: _____

Date: _____

(Courtesy M. Griscavage, HSMRC, NJIT)

**THE ACCOUNTING FUNCTION:
COLLECTING AND REPORTING PERFORMANCE DATA**

A budget must be integrated into an accounting system. Since centers are constituent units within their respective universities, they are required to use and comply with the university's accounting system. While this relieves the center of a variety of burdens (e.g., writing payroll checks each month) it can also present a number of problems: specifically, a mismatch with a single PI-based system and timeliness of reports.

Most university grants and contracts accounting systems assume funding for an individual investigator. Such awards typically involve a fixed amount of money, from a single source, which arrives on campus once, with a set overhead rate, which can be spent by one or two PIs, within a fixed time period, and with little budgetary flexibility.

In contrast, the typical center award involves a variable amount of support, from multiple sources, often with different overhead rates, which arrive at different times during the year, which can be spent by a large number of PIs, over extended and multiple time periods, and with considerable budgetary flexibility. In short, center-related bookkeeping needs can present precedent-breaking challenges.

Fortunately, university financial staff are professionals who, if they understand your needs, will usually try to meet you half-way. Thus, many of these problems can be solved by sitting down with representatives of your grants and contracts office and negotiating an accounting system which is customized to your needs including different fund accounts, a system of prime and sub accounts, authorization to spend money on meetings and meals, billing system for members, etc. If, in spite of a good faith effort by both parties, you discover your financial needs cannot be met at the university level, it may be time to sit down with higher administrative officials.

Unfortunately, the second problem, getting timely feedback on expenses and revenues is a less tractable problem. If the experience of our I/UCRC colleagues is any indication, university-level accounting systems provide accurate but very late information for post-action auditing. It is not unusual for these systems to lack a procedure for recording encumbrances (e.g., already committed salary funds) and for postings to be three or more months behind. Center Directors who desire a modicum of financial control should develop a local accounting capacity.

Strategies for developing I/UCRC accounting capability vary. In some cases, a department or college-level accounting system may be more responsive and capable of providing timely and accurate information. When this is not a viable option, most centers develop and keep an unofficial set of books (e.g., set up in-house grant management software to record real-time expenses that could be reconciled with the university accounting system on a monthly basis). In some cases, centers have been designated university cost centers, with the authority to maintain their accounts. This has an extra advantage because it will allow the center, under certain constraints, to authorize expenditures before funds arrive. While the latter two strategies involve a significant investment of staff time, they result in a responsive financial control system and are well worth the investment.

COMPARING AND INTERPRETING FINANCIAL ACTIVITY

Comparing performance to an established standard involves comparing expenses against budgets. We will discuss two approaches, a balance sheet and a cost analysis. To be useful, both require timely feedback on financial activity.

A Balance Sheet Report

A balance sheet report represents the center's financial picture. It projects sources and uses of funds for a given time period. A bookkeeper's ledger, it has a summary of revenues broken down by funds and major expenses (see Figure 8-7). Since they highlight uncommitted funds, balance sheets are particularly useful when a center needs to determine how much funding is available to support new projects.

Since center memberships and projects typically include multi-year commitments, centers should also consider two- or three-year balance sheet budgets which take into account longer term commitments and forecasts. For instance, a center which has made a lot of multi-year commitments may not want to commit all its discretionary funds in a given year if it means it won't have the opportunity to start new projects the following year.

Cost Analysis Report

Another straightforward way of comparing financial activity is cost analysis whereby actual costs are compared with the original

Figure 8-7 Sample center-level balance sheet budget.

BALANCE SHEET BUDGET FY1997			
Center Name: _____			
Time Period: Fiscal Year 1997			
Revenues	(\$k)	Expenses	
Memberships	300	GENERAL ADMINISTRATION	
Affiliate Memberships	30	Salaries and Fringe	117,800
NSF Funding		Office Supplies and Miscellaneous	7,000
I/UCRC Program	25	Travel	5,000
TIE Grants	80	Evaluation	8,000
Other	50		
Governmental Grants		RESEARCH PROJECTS	
ARPA	80	RESEARCH FOCUS I: Sci./Tech Base	
NIH	50	1. Project A-1, Prof. Smith (8/94–9/96)	85,000
Other	30	2. Project B-1, Prof. Jones (8/94–9/96)	75,000
		RESEARCH FOCUS II: Applications	
Governmental Contracts		1. Project C-1, Prof. White (6/95–1/96)	57,000
EPA	80	2. Project D-1, Prof. Black (7/95–4/96)	60,000
Other	60	RESEARCH FOCUS III: Technology	
State Funding		Project E-1	55,000
DOT	40	ENHANCEMENT PROJECT	
State I/UCRC	50	Project F-1, Prof. Blue (8/95-6/96)	65,000
Other	10	1:1 PROJECTS	
Special Projects		Discrete projects	340,000
XYZ Contract	40		
ABC Grant	50		
Other	25		
Total Income	1,000,000	Total Expenses	(874,800)
		Balance	125,200

(Courtesy M. Griscavage, HSMRC, NJIT)

budgets (see Figure 8-8). This kind of comparison would be particularly appropriate at the project or research theme level and would help PIs and managers monitor the spend rate of particular projects or accounts.

Figure 8-8 Sample project-level monthly cost analysis.Month/Year: 6/97

ACCOUNT #: _____

Project Number: INCN-52
Project P.I.: M. EvansProject Dates: 5/25/96 - 5/31/98
Institute of P.I.: Another U.

Description	Granting Agency	Match	Expended to Date	Variance
Faculty 1/8 AY: \$6,500	6,500		3,250	3,250
Post Doc 18%: \$4,395	4,395		1,753	2,642
Analytical technician: \$4,375	4,375		2,917	1,458
Fringe benefits @ 28%	4,275		2,217	2,058
Research hourly (GA/RA)	4,770		2,000	2,770
Fringe benefits @ 9%	430		180	250
Supplies	5,000		2,100	2,900
Travel		1,000	200	800
Other operating expenses computer operations	1,200		600	600
Tuition remission, fees	7,200		3,600	3,600
subtotal:	38,145	1,000	18,817	20,328
Indirect cost 68% of salaries:	15,667		6,745	8,922
Equipment: Mixer \$3,000	3,000		3,000	0
TOTAL:	56,812	1,000	28,562	29,250

(Courtesy M. Griscavage, HSMRC, NJIT)

CONTROL SYSTEMS AND DECISION MAKING

It is easy to get hung up in the minutiae of budgeting and accounting and “miss the forest for the trees.” It is important to remember budgeting and accounting contribute to three control functions: go/no-go, steering, and post action.

Go/No-Go Control: Budgets as Planning Documents

Budgets should illustrate what you intend to do, when you intend to do it, and the amount of resources it will take to get it done. When a center submits a budget that commits a significant portion of its discretionary funds to purchase equipment, or to hire a technology transfer assistant, or to send a team to a meeting in Tahiti, those plans can be subjected to go/no-go control by the IAB.

The same is true for budgets submitted by PIs. However, one can tempt over-control by submitting overly detailed budgets. In general, IABs like itemized project-level and center-level budgets but do not care to know which meetings Dr. Levine plans to attend or precisely how the director will use the recruiting budget. In fact, some IABs have authorized directors to spend up to 10 percent of the research budget at their discretion on promising quick-breaking research opportunities. Thus, directors and PIs need to use their judgement and feedback from the IAB to determine how detailed a budget they should submit.

Steering Control

From a management standpoint, the most valuable aspect of budgeting is the ability to exercise steering control. When budgets are coupled with performance reports on spending rates and progress in achieving milestones, managers can interpret variances, decide if they are outside acceptable tolerances, and if needed, take mid-course corrections monthly or at least quarterly.

In order to exercise adequate control at the project-level, PIs need monthly or bi-monthly updates on their expenses to ensure that they are not underspending or overspending their awards (see Figure 8-8). Center Directors need the same information on all project awards, plus monthly or quarterly updates on achievement of project milestones. They may use this information to allocate additional resources in cases with impressive early research, or to close down projects which are floundering. Since there are often late or disputed payments, or unsigned contracts, etc., the Center Director must have information to monitor revenue flow and act when necessary.

Post-action Control

Once budget spending has been realized, I/UCRCs can measure how close research results match the plan. A final report and budget information provides the IAB with a lot of information on how much bang they got for their membership buck. This kind of control requires the center to produce performance reports which interpret revenues vs. expenditures; expenditures by program research areas; expenditures by budget categories; personnel costs broken down by budget category; and any of the preceding over time. This type of information can usually be communicated effectively via simple graphs like pie charts and bar charts.

Financial controls do not compensate for weak management. They are an effective, quantitative tool that can improve planning, help in asserting management control, and generally produce an organization that is effective, efficient, and on course.

APPLYING CONTROLS FOR OPERATIONAL ISSUES: USING INTERNAL ADMINISTRATIVE DATA

There are numerous areas besides finances within a center that the director may wish to control. This section discusses how to use administrative data, the kind of data contained in a Management Information System, for control of operational issues. Rather than discuss each area of control in only a general way, we present a specific case study that deals with the important concerns of all centers—member retention.

Selecting the Variable

Quite obviously, member retention is a key area that must be controlled. Simply looking at whether a firm is retained or not has little value. Like most post-action control information, feedback is usually too late to correct the problem. From another perspective retention equates with member satisfaction, one of few variables that the center can control.

Defining the Units of Measure

What are the appropriate units of measurement for satisfaction? Unfortunately, most directors don't have direct and accurate information on member satisfaction. A director would need to focus on process measures that appear to be related to member satisfaction.

Feedback provided by IAB members and monitors during semi-annual meetings might prove useful, particularly if documented carefully. Complaints would be particularly valuable. A strictly objective measure would be how many complaints have been received. Satisfaction related to the frequency of personal and phone contact between a member and center personnel, and the number of projects a member rates “very interested” during the “LIFE” evaluation process are other measures. Members who check “Not Interested” in 40 percent or more of a center’s individual projects on the LIFE form are candidates for withdrawal.

Establish Standards

A performance standard for variables might be 100 percent retention, even if some members leave for reasons beyond the center’s control. Alternatively, very high satisfaction is a reasonable, realistic goal. However, interpreting very high satisfaction may be difficult. In terms of measures the standard might be something like these: no complaints logged during the past year, at least two personal visits to the members site each year, monthly phone contact reported, and at least three projects rated very interested.

Create and Implement Measurement Tools

Although the variables described above do not require a sophisticated measurement system, valuable information will be lost without some systematic record keeping system. One tool, for use by the director, might include a log or diary used to record conversations on types of changes made in projects. Another tool is a master log of member communications (see Figure 8-9).

This form would provide a vehicle for tracking frequency of contact with members. The complaint column is checked whenever the caller or visitor overtly voices a complaint (e.g., the level of research hasn’t been up to your usual standards) or is perceived by the receiver to be making a covert complaint (e.g., I’d like to

Figure 8-9 Member communication log.

Staff Member X						
<u>Date</u>	<u>Contacted by</u>	<u>Spoke to</u>	<u>Reason for call</u>	<u>Action</u>	<u>Complaint</u>	<u>Praise</u>

receive the materials in a more timely fashion). Complaints must be handled right away.

Comparing and Interpreting

Comparing the actual performance to the standard is measured by the number of complaints or contacts that meet or don't meet the standards. To aid in interpretation, a contact log should describe the complaint (see Figure 8-9).

Actions

Actions are almost always remedial because the system is designed to inform the director how best to serve the members. When any shortcoming is detected, it is the shortcoming that should be fixed, rather than the system. If anything, the system may need to be more sensitive; for instance, something is amiss if a member leaves who appeared completely satisfied. The simplest kind of corrective actions may be based on the complaint log. All complaints should be discussed at the moment they arise, a decision made how to handle it, the action taken, and the member firm contacted with the proposed solution. Contacts can also be monitored periodically. One center reviews its contact log half way through the year and assigns faculty to visit members who haven't received at least one visit by that point. Another center asks PIs to report numbers of contacts in their progress reports and does not consider any new project without comment from at least two IAB members. Some centers schedule a meeting with members whose LIFE evaluation forms report less than three projects "interested." This is more likely to produce a positive outcome than a meeting scheduled after a member resigns.

This control system is designed to increase member satisfaction by paying attention to member concerns. In the long run we believe this will result in a more effective center with a larger membership.

A variety of other variables tap into satisfaction and retention. However, control systems based only on MIS data have drawbacks because such data is often poorly or inconsistently collected or highly subjective to personal biases. As a consequence, some centers strengthen their control systems with data provided by evaluation research.

CONTROL AND EVALUATION RESEARCH

According to Weiss (1972), the purpose of evaluation research is “to measure the effects of a program against the goals it sets out to accomplish as a means of contributing to subsequent decision making about the program and improving future programming” (p. 4). Substitute “center” for “program” and this definition reads like the concept of management control developed throughout this chapter. Both involve the collection of data to assess goal attainment and strive to help management and program sponsors to assess and improve organizational performance. Evaluation research even has an analog for the three forms of control we have described: planning evaluation corresponds to go/no-go control; formative or process evaluation corresponds to steering control; and summative evaluation corresponds to post-action control.

There are significant differences that have implications for your control system. Evaluation research usually involves collection of external not administrative data, particularly about outcomes and impacts. It uses sophisticated social science methods, research designs, questionnaires, interviews and statistical analyses to enhance reliability and validity and to strengthen inferences. Outside professionals also are required in evaluation research.

Although evaluations are usually mandated by an outside sponsor like the NSF, to serve their purposes, evaluation research, when it’s done carefully and thoughtfully, can provide management with valuable feedback about program processes and outcomes.

Evaluation Research in an I/UCRC

For the past 15 years, the NSF I/UCRC program has mandated a standardized evaluation of all centers, executed by an external, independent evaluator. This was discussed earlier in this volume. The I/UCRC presents several challenges for an evaluator: I/UCRCs are composed of many constituencies—the university, NSF, faculty, students, the IAB, and the research field—and each of these may require different types of information. Further, evaluation of research is difficult due to the uncertain nature of the activity, the complexity of its processes, and the fuzziness and latency of its outputs. The I/UCRC evaluation system, which has evolved over the past 15 years, addresses these problems.

The I/UCRC Evaluator

NSF augments awards so that centers will have the resources to hire independent evaluators. The NSF standardized evaluation

includes: (1) submitting a yearly Evaluator Report detailing the center's progress, (2) conducting exit interviews when members leave the center, and (3) administering and analyzing an annual process and outcome questionnaire to IAB members and associated faculty. The evaluator must attend the center's semi-annual research review meetings, other significant internal meetings, and semi-annual meetings of all I/UCRC evaluators. These duties are described in detail in the "I/UCRC Evaluators Handbook" (NSE, 1997).

As important as these formal requirements are for compliance and the information they may provide to the Center Director, I/UCRC evaluators may play a number of informal roles. They are skilled, objective observers. They may act as a communication channel between the center and the IAB. They may be asked to troubleshoot center problems or be roving ambassadors and information collectors at IAB meetings. They are the center's link to the network of 50 other center evaluators and a data bank of all center activities during the past two decades. In fact, the number of ways that a Center Director may use the services of the evaluator are constrained only by the Center Director's imagination.

It would be a mistake to only view these evaluation tasks as external mandates. Each of them has important utility within the center and each may be used to enhance the Center Director's control.

Evaluator's Report (ER)

For start-up centers, this report documents the ideas, plans, and efforts that led to the planning grant/meeting and formal proposal. For continuing centers, the ER documents critical incidents and provides important information about the evolution of the center. Internal uses for this information include monitoring progress, milestones and achievements, and describing problems and opportunities to be attacked in the coming year. Since center stakeholders sometimes feel more comfortable confiding anonymously to the center evaluator, this report can produce the kind of surprise that is the hallmark of a good control system. Some centers have found that giving new IAB members the most recent ERs is the best way to introduce them to the operations of the center (see Appendix 8-1).

Exit Interviews

This procedure involves an interview with all members who are about to or have already left the center. However, given all the ef-

fort required to recruit new members, it is obviously important to do everything possible to keep them within the center. One strategy employed by some centers is a “pre-exit” interview: At the first sign that a member firm is considering leaving, the evaluator phones them to ask why and if anything might be done to fix the problem. Some factors are beyond the center’s control, such as a corporate decision to curtail external research affiliations. When this occurs, the evaluator documents the factors that went into their decision. This is an example of post-action control. The evaluator can also obtain information regarding the basis on which a member would rejoin the center.

Process and Outcome Questionnaire

The results of this data gathering activity form the center’s best longitudinal data base. This feedback from member and faculty questionnaires can be incorporated readily into a steering control system. The process and outcome questionnaire forms the core of this activity. Most IAB representatives do not have the time to answer very long questionnaires so it is short enough so that individual centers can add a few site-specific questions. The process and outcome questionnaire was developed by a team of I/UCRC evaluators with input from IAB firms and NSF I/UCRC program officers and the questions have gone through extensive piloting and preliminary psychometric evaluation.

Using the Process and Outcome Questionnaire for Management Control

The I/UCRC Process and Outcome (PO) questionnaires, available from your evaluator, solicits industry and faculty feedback on program processes, various outcomes and center management’s need for steering control. The questionnaire includes closed and open-ended questions. Outcome questions focus on the center’s impact on R&D, commercialization and other benefits. Process questions focus on the research program, level of interest, satisfaction with quality of the researchers, administration, satisfaction with project selection process, general satisfaction and membership renewal intention.

The industry and faculty PO questionnaires are administered annually to all IAB members by the local center evaluator. Analyses are performed locally by the evaluator and nationally at North Carolina State University. This system facilitates quick local feedback and benchmarks local performance. We can illus-

trate how evaluation data can be used as part of a control system by using the same issue addressed in the previous section—member satisfaction.

Defining the Units of Measure

Member retention and satisfaction are measured by responses to rating scales. One item focuses on intention to renew membership (1 = definitely not renew to 5 = definitely will renew). Seven items focus on different aspects of satisfaction with the research program, and eight items focus on satisfaction with different aspects of satisfaction with center administration (1 = not satisfied to 5 = very satisfied). In addition, members report how to improve center performance in each of these areas.

Establish Standards

It can be very difficult to interpret the meaning of an average satisfaction score of 3.5 on a 5-point scale, but PO data are collected annually and program-wide and so meaningful standards for interpreting these data have been developed. One standard is to meet or exceed last year's rating on all items. Another standard is to score at, or above national norms for the I/UCRC program.

Comparing and Interpreting

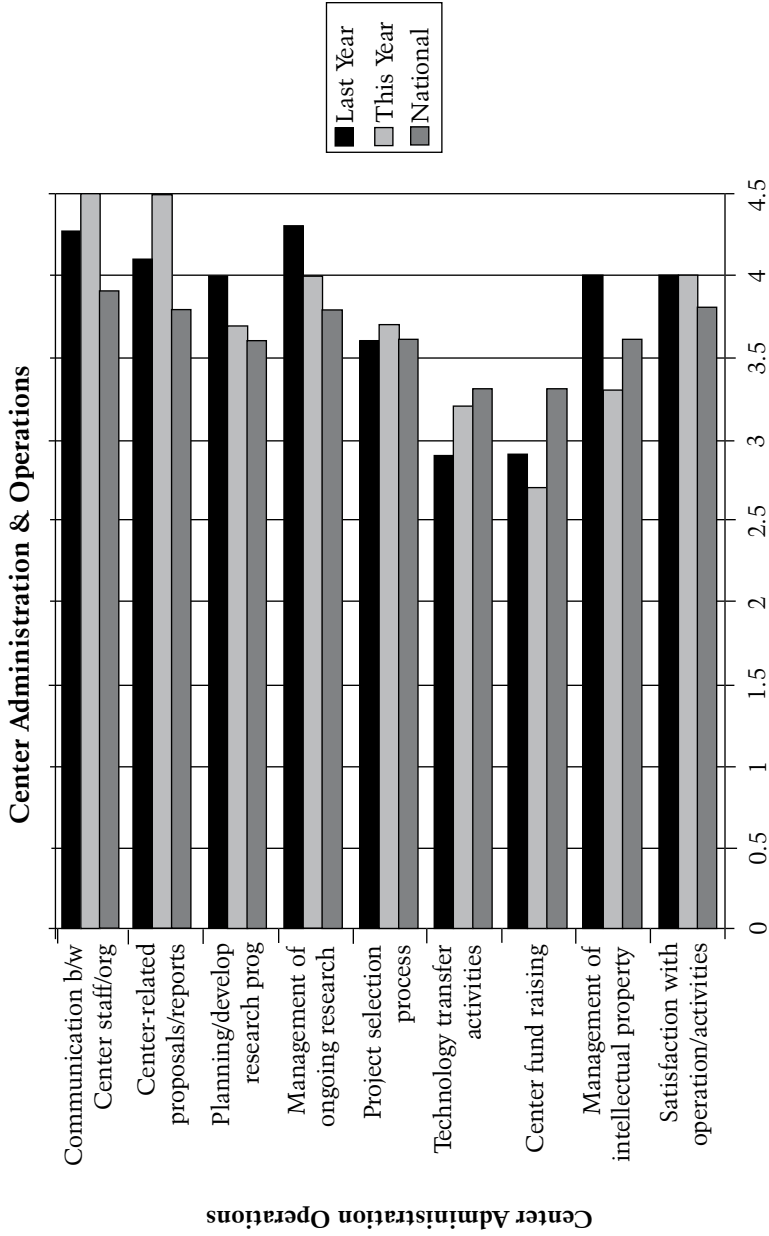
Comparing and interpreting performance in this system is quite straightforward. Center mean scores for the current year can be compared to last year and to the "norm" for the entire I/UCRC program. If a center is performing on a par with the previous year and above national norms on all areas except two, these are the areas on which the Center Director should focus. See Figure 8-10.

Actions

What action should a Center Director take given this kind of feedback? To some extent the answer depends upon what the director already knew and various local circumstances. If the information constitutes a surprise for the Center Director, e.g., a member reports renewal is unlikely, at a minimum the director would want more information about the relative dissatisfaction with the research program's focus and relevance to short-term needs. The Center Director will want to find out which firms are uncertain about their renewal and try to change their minds. On the other hand, if the Center Director already knew about a problem, this may reinforce the course of action already planned. It's worth

Figure 8-10 Typical process/outcome feedback display.

During the past year, how satisfied were you with the following features of the Center's administrative operations?



noting that standards, particularly outcome measures based on national norms, should be interpreted with caution. Firms look for different things from a center. Some outcomes reflect differences in values and expectations. For instance, investment in follow-on research is not an expectation of every IAB member, so it is not an accurate measure for every center. Like all control system data, PO feedback is only valuable if it is interpreted by a well-informed manager.

Summary

A Center Director should encourage the incorporation of evaluation into a broad and continuing system of management and control rather than isolated or occasional evaluations. The surest way to achieve this goal is for the Center Director to support and apply the work of the evaluator. Incorporating evaluation into a system of control is the same as adopting any new innovation and requires commitment, education, and resources. The Center Director provides commitment and the National Science Foundation provides the education and resources in the person of an I/UCRC evaluator.

Evaluation is an important informational resource in the management and control of a center. The individual center evaluator, and his or her support infrastructure (NSF and the network of center evaluators), are resources that Center Directors need to draw on. As a minimum, it is the evaluator's job to keep the center in compliance with NSF guidelines. Many centers have found, however, that the independent evaluator serves an important role in the efficient operation of the center. As a Center Director, your job does not require you to perform evaluations; it does require you to attain the maximum benefit from the evaluation resources made available.

MANAGEMENT CONTROL CHECKLIST

Thinkers from Aristotle to Peter Drucker have written important books about how to maintain effective control. The following five rubrics encapsulate ways of maintaining effective control over an I/UCRC:

- Control begins with a clear sense of organizational purpose. When goals are set, strategies are developed to help meet them. All I/UCRCs began with a proposal of their purpose,

goals and objectives which should be re-read from time to time to make certain that they are still appropriate. Everyone affiliated with the center needs to understand and appreciate them.

- There is no one, best, control mechanism. Different areas and variables are amenable to control by a wide variety of tools that the director should use: university accounting procedures, questionnaire, center policies, voting protocol of the IAB, and personal judgment.
- The concept of control should extend to all areas of the organization's operation. The director needs to control everything from financial and capital resources, project quality and timeliness, center personnel and graduate student production, to member satisfaction.
- Decisive action is the hallmark of an effective control system. Deviation in time, cost, or performance warrants action to redirect the center's activity.
- Effective control is a balance between over-control and lax control. Centers need to be especially aware of the university tendency for over-control of faculty. Directors must be specific and frugal in their requests for information from researchers and project leaders. It is possible to be in control without being controlling.

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APPENDIX 8-1**Evaluator's Report (Yearly) (ER)**

General Instructions: Summarize the center's recent history (last 12 months or since the last history was prepared) by responding to the following questions.

1. Goals and objectives

Please describe the center's primary organizational and technical goals and objectives.

Instructions: This question can be answered by listing a center's official (written) and/or unofficial (but acknowledged) goals and objectives. Goals and objectives should be updated or elaborated upon (e.g., the basis for inferring informal goals) as needed. You should indicate if your answer reflects a change from previous years.

**2. Environmental/Institutional/Organization/
Research changes:**

Please describe any changes (positive or negative) which have occurred during the last year. Changes might occur in the following domains:

- *environment* (e.g., decline in industry's competitive position)
- *institution/university* (e.g., partnerships with other universities, shift in university priorities)
- *organization* (e.g., financial stability, structure, policy, planning, personnel)
- *research* (e.g., new or modified thrust areas).

Instructions: please address each domain. Emphasis should be on *significant* changes which might influence the center's ability to achieve its goals and objectives. Please attach an updated timeline which includes these changes.

3. Center accomplishments

Please describe any accomplishments or impact the center has had in the following areas:

- *knowledge/technical advances*
- *technology transfer*
- *educational impacts.*

In addition, comment on accomplishments which may reflect unique center objectives (e.g., forging international linkages, etc.)

Instructions: Evaluators are encouraged to obtain the information needed to answer this question from a variety of sources, including: program records (e.g., center's annual report), responses or comments provided in the P/O questionnaire, discussions with CD, IAB members and faculty.

4. Analysis

Based on the information provided above and other relevant information, comment on the health and vitality of the center. What are the implications of the various environmental, institutional, organizational and research changes? Is the center making adequate progress in achieving its objectives? What are the major obstacles and/or opportunities which may affect the center's ability to achieve its objectives during the next one to three years.