THE INTEGRATED BUSINESS INFORMATION SYSTEM: USING AUTOMATION TO MONITOR COST-EFFECTIVENESS OF PARK OPERATIONS

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The cost-effectiveness of park operations is often neglected because information is laborious to compile. The information, however, is critical if we are to derive maximum benefit from scarce resources. This paper describes an automated system for calculating cost-effectiveness ratios with minimum effort using data from existing data bases.

Introduction

Parks Canada, like most other public agencies in North America, is faced with budgets that are shrinking. It is therefore becoming increasingly hard to meet client expectations or maintain standards that agency professionals consider adequate. Parks Canada's reaction to budget restraint has been to look for more "business-like" (or private sector-like) approaches to operating parks, with the idea that this will somehow solve the financial problems of a government operation.

The authors have heard "business-like" being described in Parks Canada in many ways. For example, business-like can mean that services which provide mainly a benefit for the user (e.g., camping), should be entirely paid for by user fees. Another characterization is that parks should generate revenue wherever they can to help finance their operations. In a simpler form, more business-like can simply mean costs have to be cut or levels of service must be lowered. These descriptions are often little more than counsels of virtue. They are not very concrete guides to action or rigorous criteria for decision making.

The authors believe that, if the concept of being "business-like" is to be useful in the facing severe financial restraint, it must be taken to mean "the concentrating of resources on those operations that are most cost-effective." Cost-effectiveness here is rigorously defined as the ratio of cost to the amount of effect or benefit produced by the expenditure. For example, if the agency considers the creation of a camping experience for one night to be an effect or benefit that the agency is mandated to produce, then the cost per party night of camping is a cost-effectiveness measure. This and similar measures can then be used to compare the performance of equivalent operations to determine which are more cost-effective and which less so. Then the agency can concentrate its resources on the most cost-effective operations. This, the authors contend, would be the business-like way to live within any budget constraints. Concentrating resources on the most cost-effective activities, and thus maximizing cost-effectiveness, of course, is exactly equivalent to the private firm's profit maximizing behaviour.

The approach raises problems, of course, not the least of which is how to measure the myriad of effects or benefits, often ephemeral, of the many products which an outdoor recreation agency produces (for an example of some of the complexity, see Stanley, Beaman, Teskey, 1993). These problems have by no means been solved. But as a general approach, it appears more fruitful than repeating truisms like "We must cut costs."

The particular problem which the authors attack in this paper is the one of where and how to get the information necessary for the cost-effectiveness measures which we believe managers need. Currently, in Parks Canada, the principal management information system, the financial system, only provides the manager with information on how much his budget is, how much he had spent so far in the budget year, and what was left. In other words, it only reports costs. To operate the park as a business, the manager must now also have information on benefits, to compare to costs. These benefits can be revenue, or they can be other kinds of measures such as number of people served, or amount of resources protected, but they somehow must be measured.

Table 1 shows a hypothetical example of the kind of information that is currently available to a park manager.

Table 1. Campground costs (hypothetical).

(1) Campground	(2) Costs ($)
Campground 1	320,500
Campground 2	571,600
Campground 3	290,300

We can see that campground 2 is the most expensive. We can see that campground 3 is cheapest. But does this mean that campground three is more efficient? It could merely be smaller. Campground 1 is cheaper than campground 2, but if campground 1 is always empty and 2 full, then expenditure on 2 is in some way better. There is very little we can conclude from the data in Table 1. Managers can probably come to conclusions of some sort since they have a great deal of informal (usually unquantified) knowledge about size (it's big), occupancy (it's crowded), efficiency (it's well run), and so forth. This informal information, however, is rarely used in connection with the financial information to draw any conclusions about campground operations. Furthermore, qualitative or categorical information about the size or popularity of campground 1 compared to campground 2 does not allow anyone to compare the cost-effectiveness.

If we add quantitative effect data, we can increase the value of the information in Table 1 enormously. This is done in Table 2, where we add party night data and then use the two pieces of data to calculate a simple cost-effectiveness measure: cost per party night.

Table 2. Campground costs (hypothetical), with party-night use and cost per party-night included.

(1) Campground	(2) Costs ($)	(3) Party-nights of Use	(4) Cost per Party-night ($)
Campground 1	320,500	15260	21
Campground 2	571,600	15448	37
Campground 3	290,300	5692	51

With the addition of use data, comparison between campgrounds suddenly becomes possible. We can now see that Campground 1 is the most cost-effective, providing a party-night of camping for $21, compared to campground 3, where it costs $51 (recall that campground 3 appeared to be the least expensive campground in Table 1). A manager can now see how much must be charged if the campground is to become self-financing. If it cannot be self-financing, the manager at least sees the amount of subsidy which must be given to each party night of camping, and can start to consider whether such a subsidy level is justified. Managers now know where to look for examples of cost-effective practice which might be useful to emulate. Senior managers, examining this data, would know where to start to look for inefficiencies. In other words, with a combination of cost and effect data, we can begin to ask business questions.

Of course, campground operations are much more complicated than this. One explanation for the higher or lower costs might be the quality of service in the campground. Another might be difficult operating conditions (for example, the $51 per party-night campground may be in the high Arctic). Specialised knowledge of situations, or further data, is necessary to properly interpret the data and ratios of Table 2 and not be misled by them. However, the use of even the simplest effect data starts to promote thinking about the business issues involved in the camping operations and how to maximize cost-effectiveness.

Operational Reviews: Managers Realize the Need for Information

One of the first steps Parks Canada took to adopt a more "business-like" approach was to conduct a series of operational reviews of various park services in 1992 and 1993. An operational review is a one time, in-depth study of the costs and benefits of providing a given service across the parks system. Its aim is to find efficiencies and ways to increase the benefits relative to the costs for a given service. Operational reviews were done of campgrounds, highways, heritage canals, staff housing, among many other services. Each of these reviews required a significant effort to collect data on cost and use, on actual and potential markets, on client satisfaction and on level of service offered (in other words, on effects). Each operational review was conducted by a specially designated task force, who took on the task in addition to their regular duties.

When managers in Parks Canada's Atlantic Region conducted their campground operational review (Horne and Stewart 1994), and saw cost data used in conjunction with effect data, they recognized the value of this information. They also realised that they needed this information regularly if they were to properly manage their operations. It was too valuable to just collect it once and then forget about it. Unfortunately, they also saw that the information was cumbersome and inefficient to collect and analyze.

The operational reviews conducted in the Atlantic Region consumed an immense amount of resources. Compiling the financial, use and investment data, recoding the data and formatting the output for these reviews required six months of time and involved several individuals, some of whom worked full-time on the effort. Utilizing spreadsheets as the analysis tool, resulted in difficulties in updating data, and correcting errors, as approximately 1,000 spreadsheets were created, a volume that is simply unmanageable. Clearly, it was not feasible to do this as part of the regular annual management cycle of activities.

Managers in the regional office therefore asked the authors of this paper to develop an automated solution whereby they could easily get the business information they needed from existing data sources, without the resort to the laborious methods previously used. The Integrated Business Information System was the result.

Integrated Business Information System (IBIS)

The first question to answer then was: the cost-effectiveness of what? The Parks Canada financial system contained data on expenditures listed by organizational unit. The asset data base contained information on condition and location of assets. The use data system contained data on volumes of use for assets and sometimes at events, but did not have information on organizational units or money.

The one element that all this data appeared to have in common was the "product" or service that the client received. (e.g., camping). Organizations spent money to provide products to the user (the Visitor Services unit incurred costs to provide a campsite). Capital assets often must exist for a product to be produced (a campsite must be built in order for camping to take place, a road must exist to give them access). Users consume products (campers camps and are counted when they do so). Finally, users express satisfaction with the experience of consuming the product (campers enjoy camping). We therefore chose the product as the unifying element, and defined a set of products that exhausted what a park spends its budget on.

With a unifying element defined, it was now possible to construct a data model. A data model is a concept of how data relate to each other and a set of rules for determining which records in which data bases belong together and so can be joined. For example, the rules tell us that any cost bearing a certain code in one data base relates to any use bearing a certain but totally different code in a different data base, and that both of these relate to the name of a product which bears yet a third code in a third data base. These rules allowed us to combine data from the cost and effect data bases in order to calculate cost-effectiveness ratios.

The concept and rules, of course, had to be implemented in a software which would actually link the data and perform the necessary calculations and print the reports. There were difficulties here. None of the data sources were designed with the intent of combining their data with another data source to do calculations. Therefore, the data were not always categorized or coded the same way. The financial system collects data to ensure a manager does not spend more money than is allocated, so it is categorized by organization, not necessarily by what the manager's product is. Extra coding had to be added, and managers had code their expenses to somewhat modified categories. The asset database is used to estimate the amount of money required for the upkeep of our assets. Which assets relate to which products had to be imputed, especially where an asset served to produce several products simultaneously (e.g., a general purpose information centre, theatre and administration building). The visitor use database stores data on the consumption of park services. Even though the same type of asset or activity took place in most parks, each park could have its own code for it, even in the national, common data base. Finally, the coding often changed from year to year within the same data base and park.

A great deal of effort was therefore expended to cross reference codes that represent the same thing and to generate common codes or correspondences. Tables of information had to be created to map these relationships among codings. As well, data often had to be manipulated so that it could be made to refer to a product being consumed by a client. The result, the working data model, is the first part of IBIS (see Figure 1).

The second part of IBIS is the analysis and report engine. Once the data has been integrated, the only thing that remains is to decide which data should be combined with which other data, and what ratios to be calculated. Table 2 above illustrates the kind of output which is produced by the report engine. Records from two or more different sources, each referring to the identical product, are combined, and a ratio is calculated. The calculation and report generation are standard functions of any data base language , and were easily implemented in Microsoft Access (Microsoft, 1993), which is the particular data base software the authors used.

The advantages of IBIS over the one-off Operational Reviews was immediately apparent to managers in the Atlantic region. Once IBIS was established in a park, the analysis of cost-effectiveness could be done repeatedly without laborious spreadsheet analysis and data collection. IBIS of course uses existing data that is being collected anyway as part of other operations.

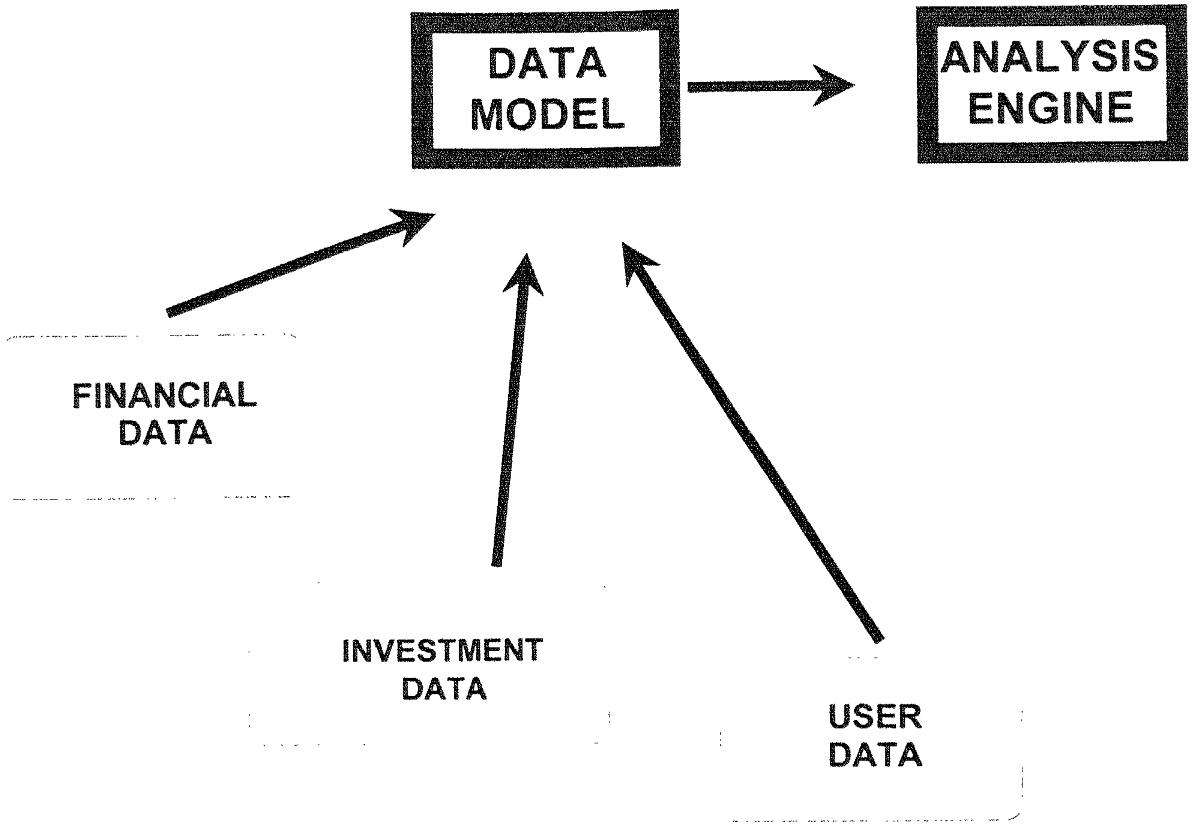

Figure 1. Parts of IBIS. Data model combines data from several data sources, and analysis engine does pre-defined calculations and produces report.

IBIS was developed as a database, while the Atlantic Region's operational reviews utilized spreadsheets. Why was this? Trade-offs are involved in selecting the "right" tool for any analysis. An approach using spreadsheets is easier to initiate and may be less intimating to the analyst. There is less conceptual overhead in identifying the relationships among the data as the user enters the values directly in spreadsheet cells, rather than in related normalized tables (For a discussion see: Beaman and Grimm 1989, Avedon 1991). This approach is very tedious, labour intensive and very time consuming. As a result it is difficult, if not impossible, for a manager to have "instantaneous" information. Updating the analysis is equally laborious: even though the spreadsheet is set up, to update the analysis, data must once again be manually entered in the spreadsheet cells.

Using a database as the analysis engine provides a method that allows instantaneous updating to be available to the manager. Databases, of course, come with their own overhead. They must be carefully designed, so that the tables used to store data do not contain redundant information. Furthermore, the tables must be designed so that "natural" relationships among the data are represented, and a user interface must be developed to allow easy access to the information. Once the database is designed and developed however, the manager has instant access to new information. The database can extract data from other sources and generate the reports, eliminating the need for manual recoding of data. As a consequence, any time the original data changes (for example, when new financial data is recorded in the financial system), a new report can be produced automatically.

To compare the two methods for analysis, estimates were drawn up to highlight the differences in time taken for various tasks in the analysis and tool development for both approaches and the time needed to complete subsequent analysis for future years (see Table 3).

Table 3: Comparison of time taken on analysis tasks for alternative approaches.

Task	Spreadsheet	Database
Time to Learn Financial System	0 months	2 months
Time Take to Complete Development	6 months	7 months
Estimated Time for Repeat Analysis	3-4 months	1-2 days

While development time is comparable, time to repeat analyses once the original report is set up is significantly lower with IBIS. This enables IBIS to be used regularly in the planning and resource allocation cycle.

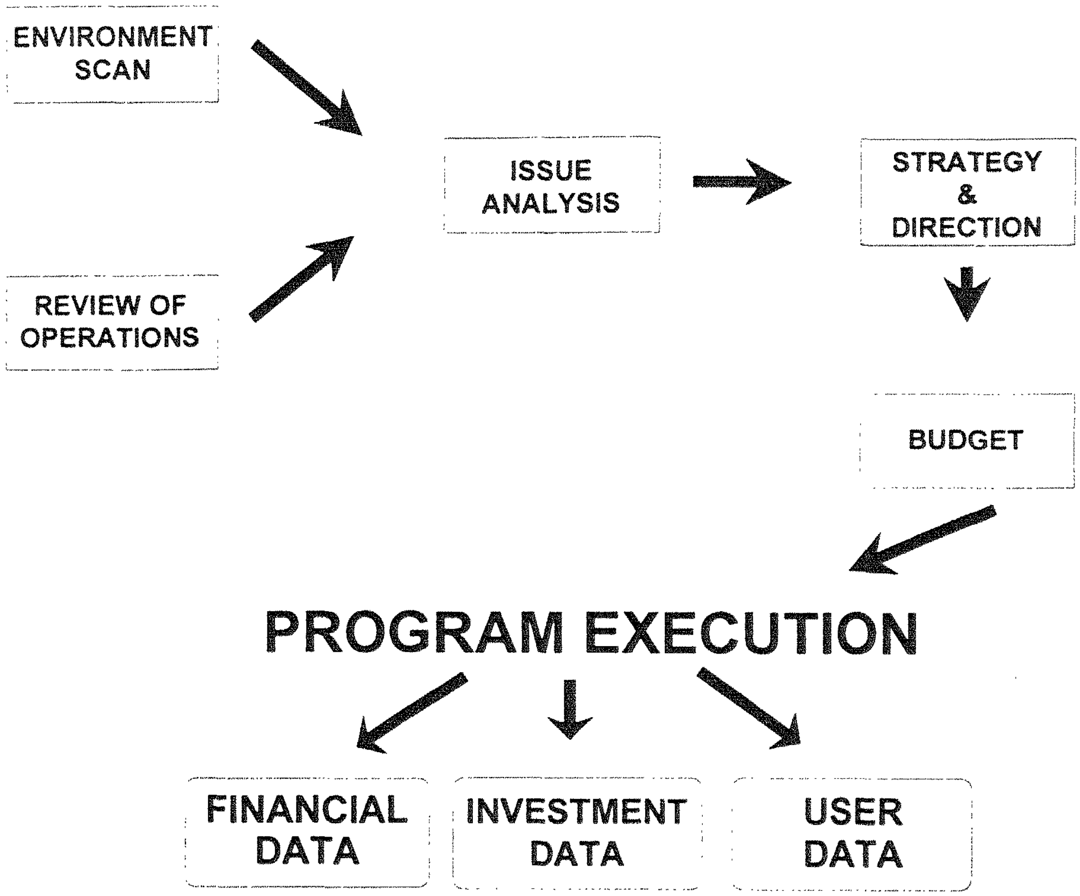

Figure 2. A typical resource planning and budgeting cycle.

How IBIS is used

Figure 2 illustrates a typical resource planning and budgeting cycle of the kind that could be used at any level in Parks Canada. The terminology and the exact steps will vary from place to place. Nor are all the stages are necessarily carried out every organization every time. It is, however, essentially the cycle that can be found in many complex organizations. The cycle starts with the **environmental scan,** an examination of the circumstances in which the organization finds itself. The environmental scan looks outside the organization to see what issues are impacting it, and what problems it will face. These could be anything from the fiscal climate to changes in market behaviour.

The **review of operations** is an examination of performance, efficiency, and cost-effectiveness within the organization. This is the stage at which the operational reviews mentioned above took place. Reviews of operations, when they happen at all, typically are major, one-time studies which are done by a specially assembled task force which spends a great deal of time and energy collecting operational data (see Table 3) and using its collective experience to interpret it. Once the review is finished, the task force typically disbands with great relief.

The combination of the information obtained at these stages leads to the identification of the key issues or problems (**issue analysis**) which the agency has to deal with, and an analysis of the options available to the agency to resolve the issues. The chosen options are set out as a strategy and sent out as instructions to the operating parts of the agency (**strategy and direction**), and resources necessary to carry out the instructions are allocated in a **budget**. The agency can then proceed to execute the program.

Something, however, is missing in the picture in Figure 2. The planning cycle loop is not closed. If we want to go through the complete cycle again, we must once again call together a task force to review the operations, as laboriously as before, something an organization is loath to do too often. This is why organizations often plan and allocate resources without going through all the steps.

Figure 3 illustrates that something important is, nevertheless, happening during program execution. A variety of information is being generated about program execution: its costs, the future investment needs it is creating, the use the program and its services and products are receiving, and a variety of other information. Some of this is being captured in automated systems.

This is where IBIS enters to complete the loop. Figure 4 illustrates that IBIS serves to scoop up the information that is being generated as a by-product of program execution, analyze it, and provide the reports for the review of operations. It is doing much of the work of the weary task force, and it is doing it automatically. It enables the planning cycle to be done frequently and be updated continually. IBIS provides the feedback on how well the strategy and direction has been achieved, as well as giving an indication of issues to be faced in the future.

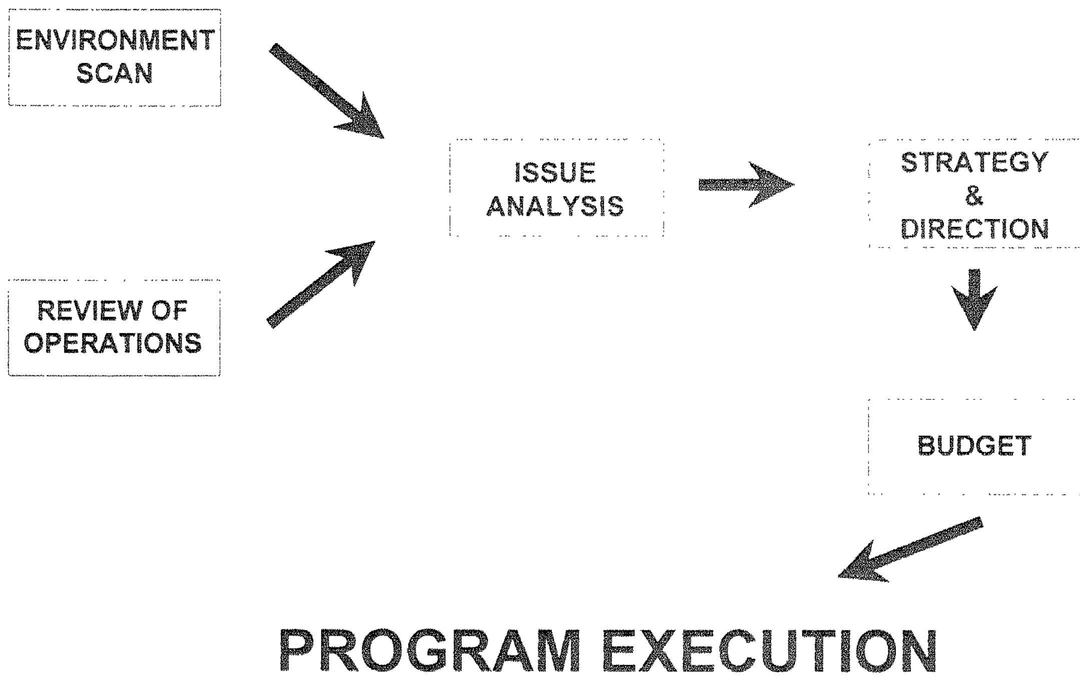

Figure 3. Program execution results in a variety of data being generated about the program.

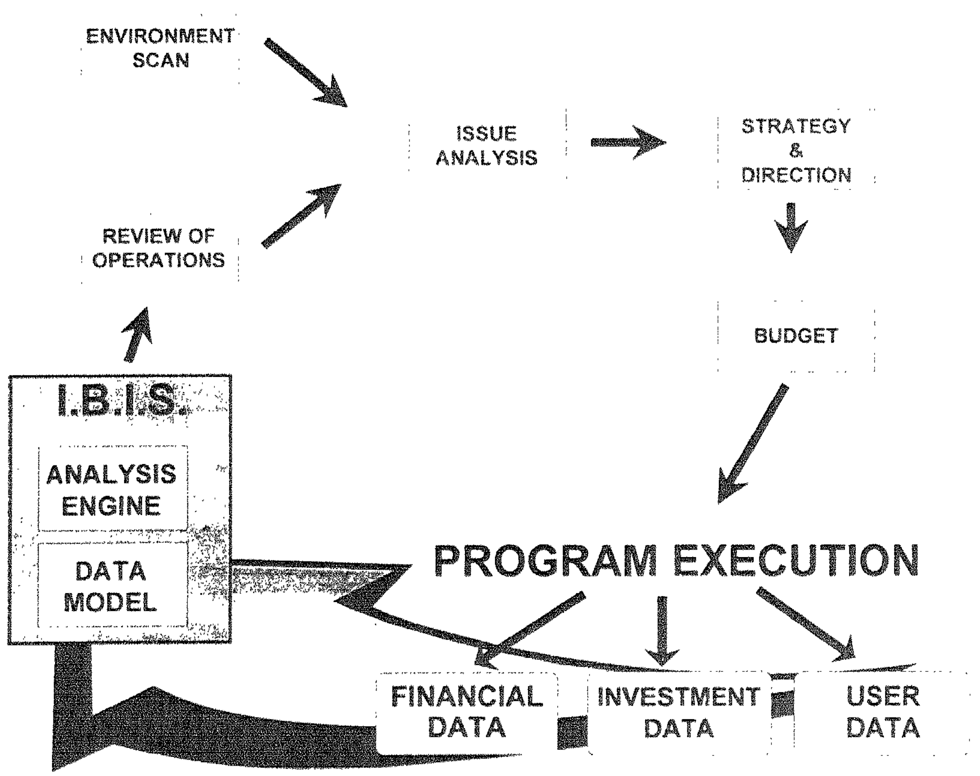

Figure 4. IBIS closes the loop and makes continual monitoring of program execution, and regular strategic planning feasible.

A "Hypothetical" Example

Table 4 shows a report from IBIS. Most of the data is drawn from the IBIS prototype application running in Parks Canada's Atlantic region. It is "hypothetical" only in that the numbers of day-users is estimated, based on weak assumptions, and the fee charged is purely speculative. No fee is currently charged for day use, and there are at this time no definite plans for such a fee.

There is a variety of information which a manager can derive from Table 4. Cape Breton Highlands, Kejimkujik and Terra Nova are all recovering their costs. Terra Nova is not as profitable as the other two parks, but weather is very harsh in Newfoundland, and discouraging to day-use, so being able to recover costs at all is probably an excellent achievement. Both Kouchibouguac and Prince Edward Island are operating at a loss. However, both these parks provide well equipped (and so expensive to maintain) beaches as part of their day use areas. The results might lead managers to consider the feasibility of charging higher fees for this extra service, thus making the areas profitable. Gros Morne profit per user-day is way out of line with the rest of the parks. This may be a place which needs special examination (or the data from the prototype is erroneous. The authors did not in fact verify the data for the prototype runs; however, even if it is erroneous, it is useful for the purpose of the example.)

Table 4. Analysis of the costs of day-use activity.

(1) Park	(2) Annual Costs ($000)	(3) Cost per User -day ($)	(4) Fee Charged ($)	(5) Profit (Loss) per User-day ($)
Cape Breton Highlands	331	1.16	2.00	0.84
Gros Morne	365	8.88	2.00	(6.88)
Kejimkujik	116	1.28	2.00	0.72
Kouchibouguac	218	3.16	2.00	(1.16)
Prince Edward Island	826	3.80	2.00	(1.80)
Terra Nova	139	1.64	2.00	0.36

Let us assume, for purposes of our example, that we have checked our data and the huge loss experienced by Gros Morne is true and not just a data error. Let us further assume that examination of the situation by experts and managers has revealed that the high cost is due to the fact that Gros Morne dayuse areas are brand new and very few visitors are yet aware of them. Therefore the costs may be reasonable in the short run, since the day use areas have not yet experienced the levels of use for which they were designed, but can be expected to in the near future. A good management strategy under these circumstances might be to determine what is a reasonable time period to wait for a profit to be realized. If past experience indicates that it takes about five years for a day use area to reach its full use potential (presumably, this would have been known when the area was built), then a reasonable profit trajectory can be built. Columns one and two of Table 5 shows such a trajectory. Managers can agree on this projection as a reasonable one, which, if it is realized, would cause no management concern.

Table 5. Comparison of expected and actual profits over five years.

(1) Year	(2) Expected Profit [management anticipation]	(3) Actual Profit [from IBIS]
1996	(6.00)	(6.88)
1997	(5.00)	(6.42)
1998	(3.00)	(5.75)
1999	(1.00)	(5.50)
2000	0.30	(5.57)

Up to column 2, the information to identify the problem could equally well have been produced by the task force as by IBIS. No task force or IBIS would be needed to produce the management strategy, just the analysis by the dayuse area manager, his superiors or subject matter experts.

Table 5 however also shows in column 3 what actually happened (hypothetically, of course). Here we can see that the losses stayed high. The number if visitors did not materialize in the time foreseen. Perhaps the original planning for construction was at fault. Perhaps other strategies such as promotion should have been tried. Whatever the case, the table clearly indicates there continues to be a problem, and that the original strategy is not working.

It is the third column in this table, which shows the results of five years of monitoring the strategy for Gros Morne day use areas, that is very hard for the manager or the long suffering task force to produce, and very easy to produce using IBIS. The difficulty of producing this column is why it is so rarely seen. Without this column, the problem at the park goes unrecognized, or at least can be conveniently hidden by the manager. With the column, management attention is focused on the problem, so it can be resolved, and the ineffective use of public money can be eliminated.

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