



BUSINESS INFORMATION ANALYSIS
AND INTEGRATION TECHNIQUE (BIAIT)

Finding The Big Payoff Areas

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Abstract

While growth of the computer industry and the computing profession have been phenomenal, this growth has not been accompanied by improved communication between top executives in user organizations and their DP managers about effective use of the new computer-based information technologies. There remains a critical need for ways to demonstrate the impact of computer applications on management's ability to get the best results out of the resources under their control.

One candidate for solving this communication and evaluation problem is the Business Information Analysis and Integration Technique (BIAIT). It has grown out of some IBM research and is being developed within IBM and by others. The current range of uses covers application development planning and implementation, marketing planning, and organization analysis; other uses are visualized for the future.

The application development planning approach receiving major attention is called Business Information Control Study (BICS). Based upon the BIAIT principles, the BICS approach produces prompt identification of problem areas having high management visibility and big potential for payoff from use of computers.

Business Information Analysis
and Integration Technique (BIAIT)

Finding The Big Payoff Areas

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Foreword

One of the deep-seated problems continuing to face the computing profession is poor communication between top executives and DP managers about effective use of new information technologies. Some research in IBM over the past several years has focussed on this problem. What follows is an overview of this research, presented at this stage of the work to solicit suggestions on directions which further studies and experiments might take.

I have not conducted any of the research and development personally. I have, however, helped guide the effort, and the results to date respond to a goal that I set nearly 25 years ago when I first became responsible for duPont's computer activity.

The goal was to establish a "business calculus" which could describe and analyze information handling processes and which could integrate solutions with the same rigor and discipline that a traditional "calculus" deals with mathematical, engineering, or scientific processes. We tested a wide range of approaches in the late fifties, but none yielded useful results.

Now, however, the work being described has those sought-after virtues of simplicity, rigor, disciplined reproducibility, and universal applicability. It may not be the final solution, but it comes closest by far to meeting the goal set and pursued for more than two decades.

The Communication Gap

For nearly three decades, computer professionals have been trying to create methodologies which express business information processes in terms that are easily understood by business executives. To date, the efforts have had marginal success, at best.

Some recent research has pointed the way to a generalized solution. It consists of a simple set of questions which lead to a crisp definition of an organization's business objectives and the related information handling required to manage the organization's resources toward those objectives. Experience to date indicates that this new methodology is effective without regard to size of the organizational unit involved or the product or service it provides. Most importantly, the description of the information system is presented in terms that are understood by both the organization's top management and the data processing management.

Two Worlds

When we look closely, there are two worlds in our organization, as illustrated in Figure 1.

TWO WORLDS

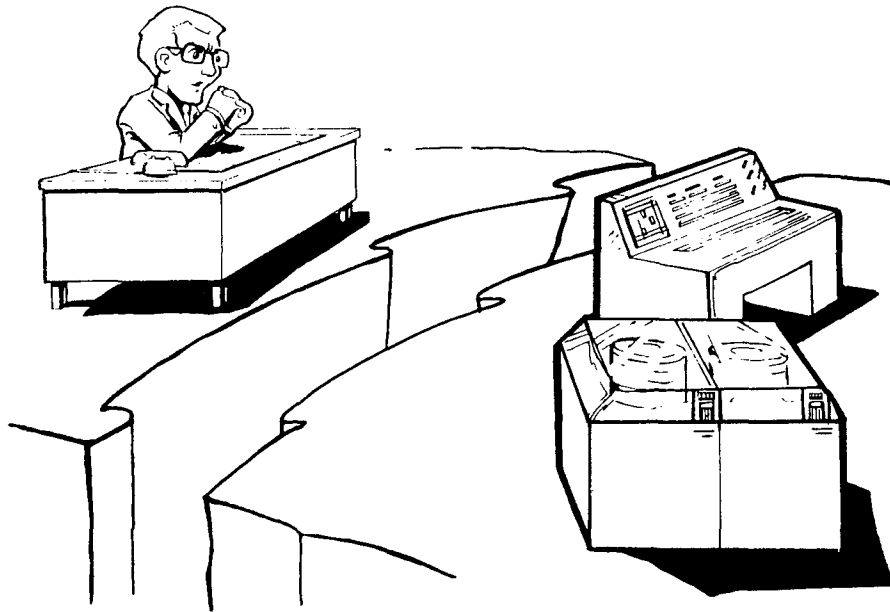


Figure 1

The Chief Executive Officer (CEO) finds a wide and deep chasm between his world and the world of the DP department.

The research reported on here has been explicitly directed toward bridging this chasm. It may be eliminating it altogether.

er. Of greatest importance, the research results apply whether manual, mechanical, or electronic means are used to serve the organization's decisions.

Only One World Exists

The reality is that only one world really exists in the sense shown in Figure 2. It is only our perceptions, biases, and priorities that cause it to be fragmented.

ONE WORLD

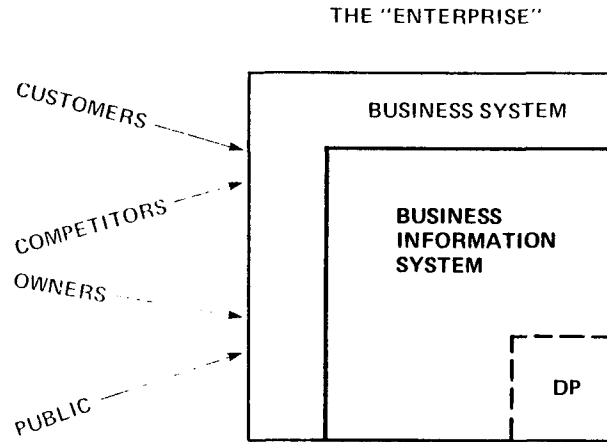


Figure 2

The one world is the "enterprise."

The "enterprise" may be industrial, commercial, academic, or governmental. It can be a total "enterprise," a location (establishment), a department, or a single occupation (or group of single skills). Every such enterprise, establishment, department, or occupation constructs a business system that is tailored to respond to external forces, which are rich in variety and priority and which have the insidious habit of changing without warning.

Every such organization constructs a business system designed to respond to these external forces and, at the same time, keep the organization alive, healthy, growing, and respected.

Every such organization that is large enough, or aggressive enough, has set up a data processing facility to play a part in the business information system. On the average, the DP expenditures reflect from 3% to 7% of the total business information expenses.

Different Versions of One World

The DP manager sees the world from one perspective. The CEO sees it from another perspective.

The DP version sees the boundaries of the enterprise as fixed and unchanged over time. The DP objective is to expand its participation in the business information processes by judicious selection of target areas for applications.

The CEO version is that the organization is under many stresses that change over time, sometimes abruptly. He sees his

role as adjusting the business system and the supporting information system to meet and overcome these stresses as they occur. Meanwhile, he sees the DP department as a black box of technology which remains fixed and unchanged within the time frames available for the organization to react to threats and stresses.

One World Goal

The goal for one world tomorrow is clear. Figure 3 depicts the goal.

ONE WORLD — TOMORROW

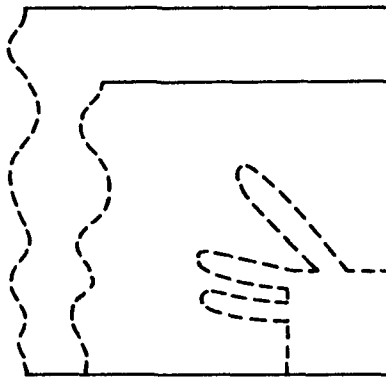


Figure 3

As stresses on the enterprise cause adjustments in the business system and its supporting business information system, the DP department will adjust its priorities, too. The DP services will be geared directly to the points of greatest stress. And they will be changed with time constants that help management respond to the stresses with better decisions on resource allocation and usage.

While that is the goal, there is a gulf of misunderstanding yet to be bridged.

How do we get the CEO and the DP department on the same wave length, using the same language, and synchronized in their priorities?

Fortunately, this question has yielded to some research that began early in the 1970's.

BIAIT

The result of the research is a theory known as BIAIT.

The name is an acronym for Business Information Analysis and Integration Technique.

The research was conducted by Donald C. Burnstine. His initial goal was to see if some better way could be found to perform product planning. Specifically, he was looking for a way to describe a customer's needs for computer products and services in terms of information handling functions rather than in terms of the products or services made or provided by the customer.

Don sought out and researched every question he could find that seemed to relate to how information handling requirements emerge in an organization. After checking out 300 or 400 questions and their implications, he found eight that uniquely and systematically characterized the way an organization uses information -- independent of its size and independent of the products or services it provides.

After another year or so of research, he found that one question was redundant and was not needed. So BIAIT now has seven questions -- a prime and lucky number -- which provide the systems analyst with a complete boundary around the information needs of the organization.

BIAIT Orders

Before reviewing the seven questions, it is important to recognize the simple foundation on which the BIAIT theory is constructed. It is the concept that every organization must receive an "order" before it does something or produces something.

An "order" can take many forms, some formal and some informal. It can be a purchase order, for example. It can be a request, or it can be merely a question. An order can arise from any source external to the organization under study. The net of it is that an order is anything that requires a response from a supplier.

Thus, the view taken by the analyst is directed only toward the supplier of the ordered entity. Whenever a customer places an order, the supplier responds with a thing, a space, or a skill. So, from this point forward, we shall be looking at the organization or person who responds to an order. A simple way to keep this viewpoint in mind is to recall that if a business or organization receives no orders, it has no reason for existing.

A rigorous application of the BIAIT questions to establishments defined in the Standard Industrial Classification Manual published by the U.S. government has shown that U.S. establishments receive between four and five types of orders, on the average. Some receive 12 or more orders.

BIAIT Questions

Each of seven BIAIT questions can be answered only one of two ways. As will be seen, some of the questions require only a

simple "yes" or "no." Others provide a choice between two kinds of response.

Table I shows the four questions which deal with the supplier.

SUPPLIER QUESTIONS → ORGANIZATION LEVEL	1. BILLING?	2. DELIVER LATER?	4. PROFILE CUSTOMERS?	8. NEGOTIATE PRICE?
↓ ENTERPRISE/ ESTABLISHMENT	BILL OR TAKE CASH	LATER OR NOW	RECORD PREVIOUS ORDERS FROM SOURCE OR NO PROFILE	NEGOTIATE OR FIXED
DEPARTMENT	COST CENTER OR BUDGET	PLAN WORK OR FIRE CALL	RECORD PREVIOUS ORDERS FROM SOURCE OR NO PROFILE	COSTED WORK ORDER OR STANDARD RATE
OCCUPATION	COMMISSION OR SALARY ----- PIECE WORK OR HOURLY WAGE	SELF- SCHEDULED OR PRIORITY SET BY OTHERS	RECORD PREVIOUS ORDERS FROM SOURCE OR NO PROFILE	COSTED WORK ORDER OR STANDARD RATE

TABLE I

Table II shows the three questions which relate to the ordered entity.

There are three levels of organizational elements shown in each table to illustrate that the phrasing of the question needs to be tailored to maintain the basic concept within the decision environment that is

actually involved. While managers of enterprises may think their decisions through in terminology that is quite different from the terminology used by a single professional or small group of professionals, the information handling implications are the same, whatever the terminology used.

ORDERED ENTITY QUESTIONS → ORGANIZATION LEVEL	16. RENTED?	32. TRACKED?	64. MADE TO ORDER?
↓ ENTERPRISE/ ESTABLISHMENT	RENTED OR SOLD	RECORD WHO RECEIVED OR NO RECORD	MADE/ASSEMBLED TO ORDER OR FROM STOCK
DEPARTMENT	LOANED OR GIVEN	RECORD WHO RECEIVED OR NO RECORD	ASSEMBLE/CREATE OR PROVIDE FROM FILES
OCCUPATION	LOANED OR GIVEN	RECORD WHO RECEIVED OR NO RECORD	ASSEMBLE/CREATE OR PROVIDE FROM FILES

TABLE II

1. Billing?

At the enterprise or establishment level, the semantics are traditional and readily understood. Does the supplier bill the customer or take cash?

At the departmental level, the phrasing of the question has to fit. Is the department a cost center which accounts for each service provided or is it operating on a budget basis that requires no accounting of individual service actions?

At the occupation level, is a white collar worker on commission or straight salary? Or some combination of each? Is the blue collar worker or service tradesman paid by piecework or strictly on an hourly rate?

It becomes apparent that wide differences appear in the information handling requirements, depending on which of the two answers is correct for the specific situation being analyzed.

2. Deliver Later?

For the enterprise or establishment, the question is delivery later or now?

The department has to decide whether to plan the work involved or drop everything and go into a "fire call" mode.

At the occupation level, the question becomes whether we as individuals (or teams) can schedule the work for ourselves or whether our job priority is set by others.

4. Profile Customers?

Whether or not the supplier keeps a profile of its customers can be phrased the same way at all three levels. The profile mechanics are independent of the nature of the order or the definition of the ordered entity.

If a profile is kept, there are specific information requirements. If no profile is kept, those requirements disappear.

By the way, the numbers in the headings are going up by the powers of 2. Each question can only be answered one of two ways, hence the question's value can be assessed in a sequence that increases by powers of 2. In this instance, the answer has a value of 4 if a profile is kept. If not, the value is zero.

8. Negotiate Price?

An enterprise or establishment either negotiates the price or satisfies the order at a fixed price. Or it may do some of each, depending on the customer, the quantity, or the ordered entity. In such circumstances, there would be two different orders: one with negotiated price and one with fixed price.

At the department or occupation level, the question needs to be phrased in terms of costed work orders or some standard, non-negotiable rate.

These are the items we need to know about the supplier. They are all we need to know about the supplier to understand his business system in terms of his information handling needs. The next three questions relate to the ordered entity.

16. Rented?

If the supplier rents the ordered entity, he retains ownership with all the record-keeping implied by such ownership. If he sells it, the deed is done, and records of the transaction are quite simple, relatively speaking.

A department or occupation either loans things (like reports) and thus keeps records or gives things in response to an order and keeps no records of the transaction itself.

The questions are still going up in value by the power of 2. This indicates that the information handling complexities inherent in the questions are rising as product/service considerations take over. This current ordering of the questions is arbitrary. One of the continuing research tasks is to validate this ordering or to demonstrate that a different ordering is more indicative of complexity.

32. Tracked?

An enterprise or establishment tracks products for such reasons as warranty or recall purposes.

A department tracks a report to be able to update it, when necessary.

You and I keep track of a number we gave our management in the event that later investigation requires that it

be adjusted.

The complexity of tracking products through successive locations and owners can be enormous.

There is no information handling involved if there is no tracking of the ordered entity. As some firms and government agencies have discovered, however, there can be severe business or social problems if no tracking is done.

64. Made To Order?

The enterprise or establishment can choose to wait and make the entity to order or it can build an inventory and merely provide from stock. Assembly from stock parts upon receipt of an order is equivalent to "made to order."

A department or occupation also responds to an order by assembling or creating the response. On the other hand, the response may be handled by simply pulling something from a file.

These are the seven questions and the fourteen possible answers they provoke in the various situations we might need to analyze at any level of the organization.

What is done with the answers?

BIAIT Cells

The values attached to the fourteen answers permits adding them up. Each order analyzed by BIAIT then lands in one of 128 cells on the basis of accumulating values from the seven questions.

Each of the BIAIT cells has associated with it two kinds of analytical and integrative information, as indicated in Figure 4.

Each cell has associated with it a set of business objectives that normally come into play when a supplier receives and responds to that kind of order. Also, each cell has identified with it a set of

business processes that are required to process the order.

The work done by John Rockart at MIT on what he calls "critical success factors" is a currently useful elucidation of business objectives. He shows the ways in which these factors lead to specific reports and measurements needed to run the organization. The measurements, in turn, define the specific data requirements to support the relevant decision processes.

Similarly, the business processes have to be executed to manage specific resources, whose inventories and relationships define the specific items of data to be collected and managed.

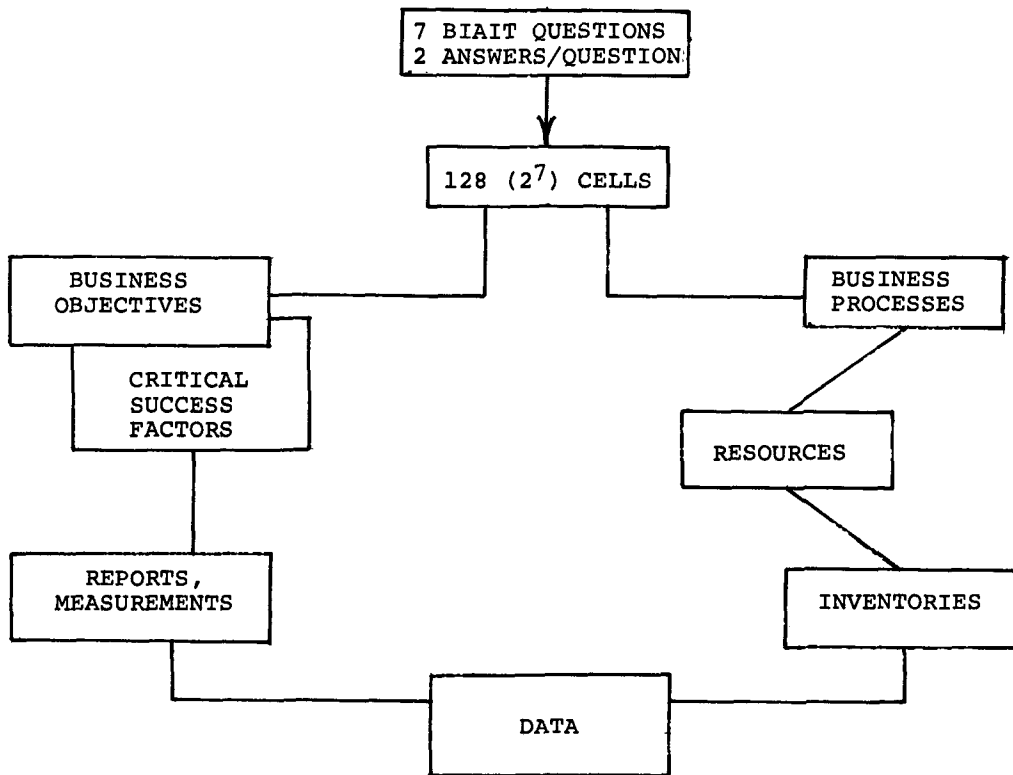


Figure 4

The BIAIT Process

Nothing has been said up to now about using computers to carry out the information processing. That is exactly the point.

The BIAIT process is designed to get full agreement between the end-user management and the analyst before anyone writes code or even installs a manual system. Both parties speak the same language. Their agreements are readily recorded. The data processing tasks and procedures, when undertaken, are directly relatable to the business objectives through BIAIT.

As currently envisioned, the process takes the seven questions about the order, locates the resultant cell, and goes through four stages to reach the next application in priority and then recycles back to set the next priority. The overall process is diagrammed in Figure 5.

The starting point, of course, is to obtain agreement between the analyst and the organization's management on a defini-

tion of the orders received by the organization. The approach evolved by David Kerner of IBM for this preliminary step is to hold a meeting with the key managers of the organization all in the same room. In a session ranging from a few hours up to a full day, the orders get defined and the seven questions answered for each. Kerner's technique has been quickly learned and used by others.

The scenario set forth in Figure 5 assumes that data bases have been built for use by the analyst. One such data base has to be the listing of business objectives (or critical success factors) which goes with each of the BIAIT cells. Similarly, there must be a listing of the business processes which exist for any organization as well as the additional processes needed for each of the BIAIT cells. Data bases of this type have been built and are being used at terminals by Douglas Snyder and his associates in IBM Canada.

THE BIAIT PROCESS

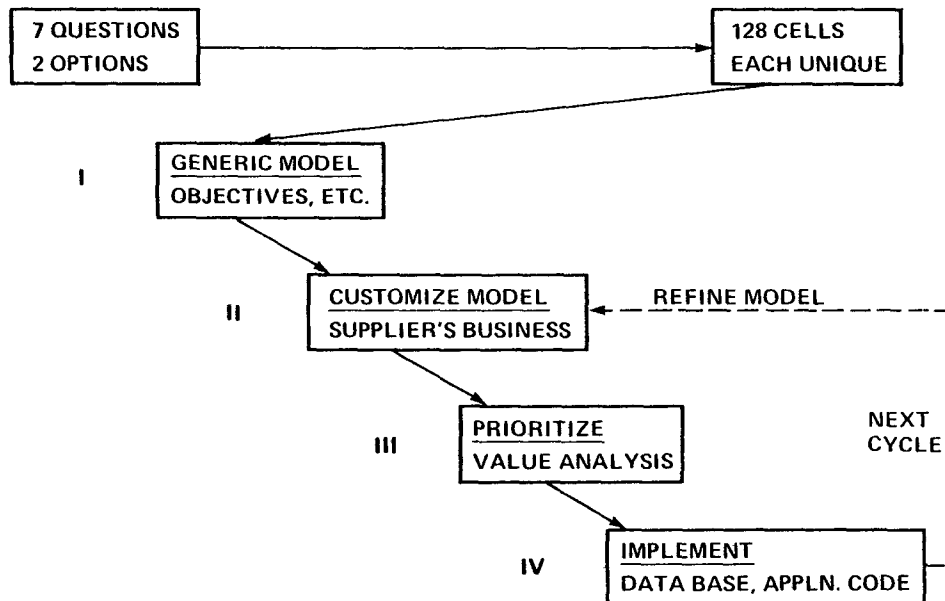


Figure 5

Stage I is entirely in the hands of the analyst, once the orders have been defined.

From the answers to seven questions, the BIAIT data base would give him a generic model of the organization or occupation being analyzed. He can read from his terminal what to expect in the way of other SIC code establishments in the same cell. Logically expected objectives (or critical success factors) and reports or measurements to be expected are provided him. The business processes to look for are automatically provided. The expected processes needed to manage the resources and their inventories are listed. And finally, a listing can be provided of the data elements needed to support operations within that particular cell, the function that should own and control each, and the users of each data element.

The target is to do Stage I in less than four hours. The product of Stage I is a generic business information model that needs to be tailored to the actual organization in Stage II.

Stage II involves getting out to interview the decision-makers in the organization to see how closely the model fits their operations.

It appears that use of the generic model in developing the interview procedures can save lots of time. The analyst and the executive do not have to invent things to talk about. The model gives them a wealth of detail that they can quickly confirm or modify to fit what shows up on actual forms and reports. The decision points (or lack of them, sometimes) become quickly identified. A crisp definition of key problems emerges.

The target for this stage is less than six weeks' duration for an enterprise or major division; much less time is needed for departments.

The product is an agreed-upon model of the actual business information flow in the organization.

Stage III involves the prioritization and value analysis needed to select the next application which is most important to top management. The analyst in his office and in a dialogue with key executives works with a large data base. In addition to the model of the business information obtained from Stage II, he has confirmed which objectives and measurements actually run the organization. He knows where the forms and reports fit in.

He also takes the time to map current applications into the model to see where overlap exists, where holes exist, and even where existing applications serve no useful purpose.

Perhaps of greatest importance, he and the management can agree upon a set of conflicts and issues to resolve between elements of the organization before work can be started on new applications.

The target is one to four weeks to develop the specifications for the next application.

Stage IV reduces all of the study work to a practical application.

The analyst and his programming assistants at their terminals convert the specifications to running code.

Presumably, their computer-based tools and aids will be managed for them by a data base management system. By this time, the organization's BIAIT model and the forms and reports supporting it will be in machine-readable form. So will the matrix defining data owners and users for each data element.

Compilers and report generators will be invoked, as needed, to convert the source code derived from the specifications into running code.

The target duration is four to ten weeks, after which the analyst is ready to recycle back, refine the model on the basis of experience, and pick the next application.

BIAIT Experience

While BIAIT is still in a late research status, and development is only recently under way, there has been some experience to support targets discussed for each of the four stages.

Don Burstine tried his theory and some of his early assignments of objectives, business processes, etc., to BIAIT cells, on some of his friends running their own businesses. He was able to provide them a complete business information system tailored on their needs in two days. He did not have to write computer code, of course, since such small businesses did not have computers -- yet.

Don also trained some summer employees from graduate schools of business, and they were turned loose on analyzing some fairly large business units. Using manual methods only, they were able to complete building a Stage I generic model in each case in 17 man-hours or less.

Based upon these experiences and many others of a similar nature, Don has continued to evolve and extend his original BIAIT concepts reported on here. His most recent publication on this later work is a paper given at the October 1979 Application Development Symposium in Monterey (1).

Business Information Control Studies (BICS)

David Kerner has been experimenting with the BIAIT process to develop efficient methodologies for application of the theory in what he now calls the Business Information Control Study (BICS) methodology. More recent uses of BICS by Kerner have demonstrated that Stage I and Stage II can be completed inside one week, using strictly manual methods.

The BICS methodology follows the broad outline already presented and carries through to the definition of data and, in one notable case, to implementation.

The generic business model of BICS includes a data model built from two types of data classes. The first type consists of data which are independent of the orders received because any organization needs certain data to manage and control its basic resources and external relationships. The second type consists of data which must be present to support the business processes required to handle the orders received.

The data classes are currently bounded by the intersection of twelve inventories, four data, and (where relevant) the fourteen BIAIT answers. As of this writing, there are 58 data classes in the BICS model.

The twelve inventories are listed in Table III along with a summary definition of each. This list of inventories is still evolving, but it has proven useful through several applications of the methodology.

The four data groups are listed in Table IV. Data inventories are subdivided into these data groups, which distinguish plan data from actual data and distinguish

value data from descriptive data. The rationale for the plan and actual distinction is that effective management and control requires that there first be a plan of action against which actual results can be tracked. Value data is the key to measuring the success of the organization, and descriptive data is all the other data about the organization and its products or services.

<u>Data Inventories</u>	
1. Employee	Represents all data about employees: permanent, temporary, past, present, or future.
2. Facility	Represents all data about land, buildings, equipment, etc., owned or leased.
3. Vendor	Represents all data about people or businesses who either have provided or are providing goods or services.
4. Money	Represents all data about cash, securities, loans, etc.
5. Outgoing Order	Represents all data which maintains a relationship between products or services ordered and the vendors involved.
6. Activity	Represents all data about identifiable work done to process internal and external orders and to provide a product or service.
7. Product	Represents all data about the goods and/or services provided.
8. Customer	Represents all data about people or institutions who have ordered goods or services or who might place orders in the future.
9. Incoming Order	Represents all data about orders received, both internal and external, and the relationships to the customers.
10. Product Description	Represents all data about the components of the product or service and the relationships of the components.
11. Process Description	Represents all data about the relationship of the product to work activity and work flow.
12. Track	Represents all data about relationship of the product or service to the customer after delivery has been made.

TABLE III

<u>Data Groups</u>	
<u>Plan Data</u>	<u>Actual Data</u>
Plan Value Plan Descriptive	Actual Value Actual Descriptive

TABLE IV

With the data classes defined, the question of accountability arises. The BICS methodology relates the data classes to organization functions through a coding system which specifies four areas of accountability:

Definition of Data and Format
Access Control
Data Content
Data Use

When the generic model of data classes is mapped to the organization functions through an accountability matrix, the stage is set for customizing the model to the actual organization and its operations. The names of the data classes are conformed to the semantics and jargon of the organization. The accountability review almost always surfaces significant problems in control of the organization's information and problems which management perceives to be inhibiting reaching the organization's objectives.

These problems are then mapped to the data inventories, data classes, and accountability matrices as a final step in setting priorities for new or additional computer applications. This is essentially the same result as indicated by the end of Stage III in Figure 5.

One instance of using the BICS methodology directly into implementation has resulted in major reductions in lines of code needed for an application and has resulted in end users writing about half of the applications. It turns out that the representation of the data groups within data classes in the BICS methodology results in relational views of the data,

thus creating a relational data base as a direct output of the BICS work. Williams has described the approach and its benefits in a paper also delivered at the Application Development Symposium in Monterey in October 1979 (2).

The Net of BIAIT

At this stage, it seems possible to draw some conclusions about BIAIT and its derivative developments.

It is a formal, yet simple analytical tool. The results are reproducible. Different analysts can check each other against formal rules.

It is a theory which is reducible to practice. There are not yet many theories in the information systems business that have the property of being usable in day-to-day business.

It is a communication vehicle that bridges the gulf between the front office and the DP department. Of great significance, the DP manager can tell the top executives what the impact will be of the changes he wants to make.

BIAIT works in a way that is independent of the size of the organization, the products or services it provides, or the structure of the organization with respect to type or level.

It serves as an attractive foundation for revitalizing the business analyst profession. And it clearly stands at the threshold of usability for those who see the need for new tools and techniques to help management find the computer applications that have big payoffs.

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