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Effective Management—Scientific Techniques vs Practical Experience

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I ORIGINALLY DEVELOPED the material for this talk in response to a request from the Los Angeles Chapter of The Financial Executives Institute that I speak on this specific subject. They asked that the talk touch on four points:

Effectiveness of Operations Research and Pure Mathematics *vs.* Practical Experience.

Are computers taking over and financial executives becoming obsolete?

Is the financial man relinquishing part of his responsibilities to new specialists—by default, by lack of training, or unwillingness to accept new changes?

What is effective management and how may the financial man keep himself abreast of new developments?

The Los Angeles request ended up by suggesting, "Please make this controversial, if you want to."

I liked this last point but the fact is, I don't have to. The very essence of the subject matter is controversial. Business literature is replete with comment on this subject. The whole matter is being churned, analyzed, and discussed and no clear pattern of thought appears to have emerged.

Comment runs the whole range from speculation of the *Jules Verne* science-fiction variety to a cynical attitude that scientific management-operations research-mathematical sciences are a fad without substance and without a real contribution to make in business affairs. A speaker on this subject has several choices open to him. He can dream and speculate that the mathematician and the computer are about to inherit, if not the earth, at least the management of our business affairs. He can speculate and philosophize on the socio-economic effect of the math-science-computer trend. On the other hand he can debunk the whole subject and conclude that all this is not for him or his company—that the subject is "way-out"—and he can be amused by it all.

I too like to dream and speculate about what may be in the future, but circumstances require that I earn my living by dealing with what is here today. It is difficult to "sell" what "may be" as a professional

service. Clients tend to want practical solutions to difficult problems—today. Implementation of a reasonable solution is the thing, even though there may be a better answer tomorrow. Circumstances therefore require that I be a pragmatist in approaching this whole subject.

My thesis is to suggest that the pragmatic view is also the position for you to take. Certainly, you should speculate on the ultimate possibilities of these developments and as a minimum keep abreast of what is going on. The returns from speculation have real limits, however, in terms of accomplishments today and in the near future. You can stand on the sidelines too long and never get in the game. If you wait for the ultimate in a computer you will never live to get one; if you put off attempting new ways to solve old problems until the perfect answer is at hand someone else will reap the rewards. Why not take what can be applied now to a problem of dimensions that you can get your arms around and have at it?

Before discussing more specifically how the pragmatist goes about getting into the game, let me very briefly identify the developments that are of concern in this subject—operations research or management science, and the computer.

OPERATIONS RESEARCH (OR)—MANAGEMENT SCIENCE*

The first identification of operations research came during World War II when persons with a variety of backgrounds but heavily from the mathematical and scientific disciplines were assigned to work on various military problems in computing trajectories, radar problems, hunt and search techniques and the like. These people were exposed to a whole series of problems in different subject matter than they were exposed to in their prior training and experience, yet found that the techniques at their disposal had application. Some of these people continued to apply their academic techniques and wartime experience to subject matter outside their immediate discipline after the war ended and inevitably gravitated into the business sphere. By the early 1950s these people began to emerge as organized groups and had begun to assert themselves as having a unique approach and common body of OR knowledge. They now maintain that operations research is a unity—that regardless of the type of situation or activity under scrutiny there is the common characteristic of a mathematical model and that all OR problems may be classified as inventory, allocation, queuing, sequencing,

*Points made in this section re characteristics of OR are taken from Ackoff and Rivett, *A Managers Guide to Operations Research.*

routing, replacement, competition, and search. These, they identify as the eight different types of problems that confront the manager.

The essential characteristics of the OR method are systems orientation, use of inter-disciplinary (or mixed teams), and the adaptation of the scientific method.

Systems orientation refers to the theory that the activity in any part of an organization has some effect on every other part. Sort of the thigh-bone connected to the hip-bone, hip-bone connected to the backbone concept. In deference to this "law" the operations researcher says he must identify all significant interactions and evaluate their combined impact on the performance of the organization as a whole, not merely on the part originally concerned. Therefore the operations researcher is exhorted to avoid the natural inclination to cut a very complex problem down to size and isolate it from its environment—to avoid eliminating aspects of the problem that make it difficult to solve, and thereby reduce it to one that can be handled by standard techniques or by judgment based on experience. Rather, it is held that a system orientation requires moving in the opposite direction, to the deliberate expansion and complication of the statements of the problem until all significant components are contained in it. This approach consists of covering the entire area under a manager's control and not of concentrating on some special aspect. I read that the ultimate of this philosophy is the total synthesis of the "firm"—a model that comprehends all the interacting factors affecting a business—external and internal.

Stated facetiously, the OR purist, I suppose, would solve nothing until he could solve everything.

This theory of ever expanding the definition of a problem before coming to grips with it may have some validity to the researcher. To me, as one seeking better answers to a client's problems for a fee, it is generally just not practical. In fact it could represent professional suicide should the client decide that problem enlargement was for *my* benefit rather than for *his* benefit. This is not to say that one should accept a client's limited definition of a problem without questioning to be certain you are dealing with the real problem or to seek to get sufficient hold of the problem to be able to make a significant contribution. Rather, it is to say that to the pragmatist a practical end is to come up with a practical improvement that can be implemented in a practical way—whether or not the solution is the very ultimate that may someday be achieved. A little later on I will illustrate from my experience the conflict that can arise between the research and pragmatic point of view.

To be fair I must acknowledge that those practicing OR in business finally must accept and do accept the limitations of the systems approach in everyday life. Their doctrine, however, calls for such limitations to be viewed as a serious imperfection, which they should strive to overcome through enlargement of the problem. I would ask: What is wrong with a substantial improvement in a significant piece of the problem? My clients seek an improvement in a known period of time for a predeterminative fee; in short, they are more interested in improving their *Operation* than in subsidizing my *Research.*

The second characteristic of OR is the use of interdisciplinary teams. This means that to qualify as an OR achievement, the solution must result from group effort—a group comprised of an engineer, physicist, economist, and accountant, for example. They say this came about originally through necessity, because of a shortage of scientists of any single breed. Later they found that the mixed team was necessary to good solutions—and I guess that only the good solutions are OR solutions. The principle here is that before you begin to study a problem you cannot anticipate its characteristics or the best way to look at it so you had best have as many different viewpoints and different solutions as possible available at the start.

On the face of it this is a difficult position to refute. Of course, the greater the number of different points of view that are focused on a problem the greater the number of angles that are likely to be discovered. To be pragmatic again, I am not convinced that this is altogether necessary to get close to the target most of the time. Given an understanding of business problems, experience in problem-solving, and knowledge of the main core of techniques known to be applicable to these problems something less than an interdisciplinary team can achieve very useful improvements.

The third characteristic of OR is the adaptation of the scientific method. Here the OR'er is referring to experimentation. He reasons that he is at a disadvantage in applying the scientific method because business problems do not lend themselves to laboratory study. The risks are usually too great to use the business under study as the "laboratory" and have the business try out various approaches to see what happens and what works. He gets around this limitation by building a mathematical model of the situation in which the pertinent factors are recognized and in which these relationships are expressed and quantified. Of course some factors are controllable and others are not and in business problems quantification necessarily requires estimation. Through

use of the model, however, he is able to experiment by trying different factors, different combinations, and different values. The moment of truth comes when the solution is implemented and applied in actual practice. In preparation for this, the solution is sometimes applied retroactively to see whether it yields an improvement over what actually resulted under the old method. All this comes under the heading of model-building and simulation—the application of experimentation.

This is really good stuff and I have no quarrel with it. The mathematics and symbology get rather heady to me since my math ended with freshman college algebra—but math knowledge is for hire at surprisingly fair prices. Further, much of the mathematical symbology offered in OR literature is in proof of a rule or relationship, and an ability to apply the resulting principle does not necessarily require an ability to understand, in depth, the mathematical gymnastics required. If it can be demonstrated that a particular in-put produces a given out-put, the underlying mathematics can generally be accepted.

Let me review quickly some experience with the pragmatic approach in terms of the three characteristics of OR. In these two instances we did not know we had an OR solution until it was all over. In our practice we don't really care whether a client chooses to call it OR or just a good solution to a complex problem—a successful result and a happy client is the test.

In the first case the management defined the problem as a need for improved procurement, so we surveyed the purchasing department. The results revealed a fair purchasing operation—a few ideas here and there—but really a pretty good job was being done.

What made it tough were the requirements they received from requisitioners. What was a routine request at 9 a.m. became rush-expedite-emergency by noon and by evening the item was likely to be canceled by the requisitioner. So we reported out and got a license to look at where the requirements came from. See—the systems approach—we enlarged the definition of the problem.

Requirements for expendable inventory replenishment—this was an airline—were determined by some traditional rules of thumb. The first rule of thumb was: Don't ever be out of anything—ever. And the rules went on from there.

Well, we went through the process of classifying the inventory items first by usage characteristics and when we had wrung out the large bulk of items subject to statistical control we structured these by the A-B-C approach. Here we went counter to the OR systems ap-

proach and yielded to this natural inclination to cut the complex problem down to size. We decided we still had too big a problem—37,000 items—so we cut it still further to get to the A items—some 2,300 items—and still further to 700 A engine items. We then selected 12 of these representing all the different characteristics we could identify and decided to develop decision rules for managing these items in terms of when to buy, how much to buy, and safety stock. We established some ground rules to require, for example, that any rules adopted for the study must be capable of application on a computer, so that we would have a pragmatic, practical system to apply to all 37,000 items in due course.

We manipulated these 12 items according to various rules and refinements by applying them to actual usage for the prior 18 months and comparing our results to what the company had actually achieved. In other words, we adapted the scientific method and used simulation. So far it was rather good; we used the system approach and enlarged the problem but then fell into the error of cutting it down to size. We used the scientific method (although we really did not know that was what it was at the time).

What about the mixed team? So far the team was two of us and a client man from provisioning—no physicist, no psychologist, no anthropologist—just we three. Not really a mixed team although we were sort of mixed up at that point. To prove we were mixed up we decided to bring in the math talent with OR experience, supposedly to tell us what the mathematics were behind the solution we had so we might improve it. Yes, we had a solution that worked—so good in fact that the ultimate system reduced inventory levels by $5,500,000 or one 707's worth—but the success was not proven out at this point.

The math talent was a decidedly pure purist and made the observation quite early that you really can't solve the problem the way we had solved it. First of all, our data were not good. We had only monthly usage figures and only usage that was recorded in a month, not what was in fact used that month. Weren't we aware of the fact that flying hours are heavier in certain months than in others, on certain days than on others, in daylight hours than at night? Didn't we take note of the fact that some items were common to more than one type aircraft while others were peculiar to a type? Our math friend said the first order of business was obviously to refine the data.

Further, our solution was based on the premise that past usage was the best available practical indicator of future usage and provided means

for monitoring this usage and coping with it through a unique system of control limits. We were told that this too was a serious defect; the right approach was to find out why parts were used at all, what triggers usage of any given part (flying hours, number of landings and take-offs and of what kind, defects in workmanship, metallurgical properties, and so on). If we could find the causes of usage we could better predict usage and manage the inventory.

So right away we had a beautifully enlarged problem—two large problems in fact, i.e., data purification and a search for the culprits causing usage. I guess we also had a third problem—the one we started with: how to manage inventories better. But then this one would have to wait its turn.

I could go on but perhaps I have made my point: Pick the right OR specialist or mathematician. On our staff we have those who have been made pragmatic; the other one somehow got away.

In solving complex problems there are common characteristics of approach having general applicability. Something very similar to the inventory problem we also applied to airline crew scheduling. The problem was how to schedule crews against a flight schedule to produce the least cost, or to get the most flying-hours for time paid.

Considering all the restrictions of CAB, company policy, and multiple union rules this is obviously a complex matter.

The company used rules of thumb and intuitive judgment to take a given flight schedule and break it into flight segments and combinations of segments to constitute a set that could be flown by a crew and that met all the restrictions. Flight pairings originate and end at a crew domicile. These are posted for bidding by the crews, who select the "package" they want—and packages are awarded by seniority.

Did these "bid packages" represent the least cost in terms of the most flying-hours for paid hours?

How did we approach this problem? First we examined the company's current flight schedule and concluded that an actual flight schedule contained too many flights and included too many data to be manageable for analysis purposes. Again, we succumbed to the temptation to cut the problem down to size. Rather than attempt to deal with all flights in a complete schedule we constructed a hypothetical airline with only a few cities and a few flights taken from the whole. Selection was made so as to preserve in the sample the characteristics of the actual system.

Each flight in our hypothetical airline was recorded on individual index cards showing origins and terminations, time of arrival and departure in Greenwich mean time, and the hours and minutes consumed. These cards were then manipulated according to various rules. For example, we began with a first-in, first-out rule. At the beginning of any period we assumed that a crew took the first flight out and took it as far as it was legal under the CAB, union, and other restrictions in the problem. The crew was then assumed to be given the required rest and took the next flight out at the end of that period no matter where it went. This iterative process was applied again and again. Each time we learned something. For example, under a first-in, first-out rule the crews rarely if ever got back to where they were domiciled until their monthly flight-hour limits were reached and they dead-headed back.

But we kept this up—try a rule, keep score, refine the rule, try again, keep score, and so on. Ultimately some fundamental characteristics became apparent. One of the most significant was that the essence of the matter was a whole series of two-city problems—how to match up crews and flights between any two cities—rather than the large problem of how to man an entire flight schedule.

The details of the actual solution cannot be gone into here as the matter is deemed confidential by the company concerned. Essentially the solution was to apply a series of rules in a prescribed sequence to make the crew decision regarding each flight in and out of a given station. A linear programming matrix is applied as part of the process and provides the least-cost answer. This procedure, including solution of the matrix, has been programmed for a computer. Now, in a matter of minutes, a proposed flight schedule is broken into flight segments, and the segments are paired and packaged for crew bidding purposes with assurance that the result is the best possible from a cost standpoint. In addition, this cost is computed so that an evaluation between alternative flight schedules, so far as crew costs are concerned, is readily available.

One sidelight was the disclosure that crew domiciles were not in all cases properly located. A shift in certain domiciles would produce still further savings in crew costs.

In effect, then, we reduced the problem to manageable proportions: built a model, simulated, and adopted an available technique (the matrix). These actions in combination with other techniques gave a very practical result.

These efforts were not referred to as Operations Research at the time—or, so far as I know, since. This merely illustrates the pragmatic approach through a logical process of problem-solving.

THE MANAGER AND OPERATIONS RESEARCH

The training and experience of most of us, myself included, has been outside the fields of science and mathematics except for some orientation courses plus an exposure here and there. This absence of formal training in the field is no reason to fear or ignore more scientific approaches to business problems. We have one thing (and perhaps the most important thing) required for successful application—an understanding of the business. Many scientific types do not have and may never be expected to have this essential ingredient. In one sense the operations researcher or management scientist is a man with a set of solutions looking for problems that fit his solutions. The electronics data-processing salesman or specialist is in a similar role; he has a solution or method and seeks his kind of problem. We have learned, and many companies have learned, that you are using the wrong approach when you invite the EDP salesman in to have a look around to see what *he* would like to mechanize. He will find areas of interest to him to be sure, but these are not likely to be those in the best interests of the management. So it is with OR and the mathematical sciences. Management must not abdicate the responsibility for recognizing the opportunity, defining the problem, identifying the important factors and relationships, guiding the effort in practical channels, and testing the solution. Doing these things does not require depth of knowledge of techniques but awareness of possibilities and the supplying of the most essential ingredient—understanding the management and the business.

Last December, *Business Week* reported on a Harvard Graduate Business School study of the extent that business management has embraced and put into practice "management science" techniques. In this study "management science" was given a broad definition to include all the sciences that can aid managers, from conventional organization theory through socio-psychology. Under this definition they found over 80 per cent of the largest corporations taking advantage of one or more of the new techniques, and this practice extending from obvious areas such as production scheduling and inventories into personnel, marketing, and R&D areas. Although this coverage is of interest, I am most interested in another conclusion. They state that no matter how competent the management-science practitioner may be in his own field,

few of them are skilled enough in the art of managing a business. As a result the management scientist may come up with sophisticated techniques based on invalid assumptions or with elegant solutions to insignificant problems. The study concludes with the moral that businessmen will have to be around to give some guidance to the scientist no matter how all-embracing his science may seem.

The mode of functioning of the great entrepreneurs of the 19th and early 20th century, held in awe for their intuitive shrewdness, is passé. The professional manager of today finds he has to grub rather hard to squeeze an inflated profit dollar out of the company's operation. Generally, he is highly educated and frequently, nowadays, has a liberal arts, legal, or accounting background. He is more and more aware of the basic approaches applied in the physical sciences, the behavioral sciences of psychology, sociology, or anthropology, and in the field of mathematics, although he generally does not have technical knowledge in depth in any of these fields. As he struggles with the problems of his business he is prone to experiment to see what these other fields might offer. The climate is right for innovation.

This development is all to the good and the operations researcher and management scientist have definite contributions to make provided they recognize—and the manager requires that they recognize—the practical limitations in business situations. Business is obviously not a laboratory situation. The economic environment cannot be excluded; measurement is not very precise; some elements cannot be measured at all but must be estimated; historical data are spotty; time factors are likely to be critical; unpredictable people-problems enter in.

Such limitations notwithstanding, a more scientific approach, higher degree of quantification, and establishment of mathematical relationships among variables in a matter produce attractive results. What you usually cannot expect is an absolute answer expressed in absolute terms providing absolute certainty to an extent that precludes the need for applying judgment. What you can expect is a reduction in the area of uncertainty so that management judgment is applied to the more significant factors with a greater probability of being right a greater percentage of the time.

Much of this technical development applies to what successful managers have traditionally done. They solved problems by defining them and specifying the objectives; by identifying the alternatives—the possible courses of action; by evaluating the alternatives; and by select-

ing the alternative course of action most nearly meeting the objective. This process still applies. What is new is the greater range of alternatives, the added degree of precision, the narrowing area of uncertainty; and, I suppose, a rationale to explain what the successful manager has been doing, to a degree, all along without being aware of it.

Some of us, I believe, come to approach anything with the operations-research or management-science label as we would a hot iron: We are afraid to touch for fear of getting burned. These labels are being applied to an ever broadening subject matter. Perhaps because these techniques have so recently come to the fore in the business arena, some practitioners who adhere to management science in its purer form feel a need to delineate from the field the others who engage in scientific management in its less pure form. This is done in part by setting up a set of characteristics and holding that any problem and solution with these characteristics is an OR problem and an OR solution. Sometimes it seems that any good solution to a difficult problem meets the standard. Suddenly we find this standard applied retroactively with Archimedes, Galileo, and others practicing OR through the ages, although they did not know it at the time. The building of such a structure serves the ego of the pure practitioner and serves to keep the more timid out of the game.

Perhaps we need two kinds of players. On one side of the net the purist, with a scientific point of view and research interest, who will follow the problem wherever it leads, largely for the problem's sake. From such endeavors come new ideas and breakthroughs of a conceptual nature. On the other side of the net we need persons with a business and profit point of view and with an interest largely in the ends rather than in the means. This other side is my side of the net and perhaps most of you will also find that you are most comfortable here. On this side the game is to follow developments closely to recognize the opportunity to apply the techniques, and to adapt and implement solutions in a practical manner. Those that have not tried this are missing all the fun and many of the opportunities to make real contributions to their company's success.

COMPUTERS

The development that permits a more scientific approach to be practical in a business situation is the computer. This is not to say that a computer is always or even generally necessary in the development of a better solution but rather in the application of the solution as part of

regular operations. A good supply of lead pencils and notepaper plus a desk calculator will take you a long way in developing a conceptual solution in most instances. The implementation of the solution where it entails the repetitive application of decision rules to considerable quantities of data is where the computer generally comes into play.

The business computer has been with us for about ten years. Only now are we beginning to learn to use EDP equipment effectively. Business applications fall into two broad categories—those things such as payrolls, billings, and disbursements that must be performed merely to stay in business day-to-day, and those areas where there are opportunities to get better answers to management questions. We all know that the first category was initially computerized in a search for clerical cost reduction. This has proven to be an elusive target in many cases. Nowadays more and more companies are coming to realize that electronic data processing equipment should be used to get better answers to management questions; to enable the company to handle more complex problems; to allow routine decisions to be handled electronically, reserving the exceptions for personal attention; to allow application in practice of theories that, although they may have been known, were heretofore impractical. These are areas of particular interest outside the financial-accounting area, and more and more we find ourselves talking to marketing, production, and chief executives who have initiated an interest.

Again in the area of computers I prefer to take the pragmatic or practical approach. Let's not consider the hardware until we have considered the problem. What are we trying to achieve? how is it to be achieved? what are the decision rules? what would we do differently if we had more or different information? These are the questions, really—not what would we or could we do if we had a computer. The computer is a means to an end; define the ends first. How simple this principle is, how commonly it is violated.

We all follow developments in the computer field and generally, I think, find the literature heavily salted with superlatives. This is a big field and getting bigger and is tailored for the big thinker. The primary problem created by the use of superlatives is to lead those who want to act now to expect too much too soon and to fail to recognize how difficult it actually is to use a computer at all.

I have no reason to question the predictions being made for the computerized life in the future. But as with OR and management science I am more vitally concerned with what can be done better with

the computer in the near future. If I were to spend too much time speculating on the ultimate I fear my client or my boss might say "that is fine but what have you accomplished lately or what can we do between now and retirement?"

A representative of Bell Laboratories is quoted as stating that automatic data processing compares to the Darwinian and Copernican revolutions, both of which changed man's ideas of himself and the world in which he lives.

A series of articles in *Fortune* magazine a few months ago draws the usual analogy of the computer and the human brain. They speak of computers that do more than substitute brute force for human cunning; they speak of computers that increasingly imitate and improve on human cunning. They speak of the immortal brain whose external memory store can be expanded indefinitely to include the wisdom of the ages. (I wonder who distinguishes between wisdom and fallacy?) This computer would be the paragon of intelligence, able to relate all its stored knowledge accurately, to reason without being corrupted with emotion, to discover new relationships between old things, to solve more problems than anyone ever solved before, even to create works of art.

Another article in the *Fortune* series deals with machines that man can talk with. We already have machines that can "talk" to each other and perhaps in some installations this may be an advantage. While the machines are busy with each other the managers will be free to deal with company affairs.

All this is interesting, as speculation, but as a pragmatist I must focus on the here and now with only an occasional look at the stars.

Another *Fortune* article deals with on-line, real-time computer systems. On-line, real-time extends the application of computers to achieve the "total system." Apparently the "total system" is one in which all relevant information on all aspects of an organization are instantaneously available. Relevant is a key word here. While the computermen are extending the capacities of their systems to cope with total systems the management-men have much to do—they have not done much—to determine what is relevant. This question has been with us for a long time already and before computers came into play. What do you really need to know to run the whole business—to run any part of the business? Not only what do you need to know but how often, in what detail, and how current must the information be? The financial executive has a real stake as well as a contribution to make in this area.

In an airline reservation system the advantage of an on-line, real-time system is apparent. In a management information system the matter of defining requirements is much more critical. Does the manager need to know, or is he able to know, anything about everything all the time? I recall learning that the manager should think ahead and not be concerned with what is happening at the moment except as it may give a clue to the future. Others at the lower echelons are concerned with the hour-to-hour problems of every day. If we are not careful we are likely to build computerized information systems that cater to the top manager's passion to feel and react to the bumps in the road being traveled at the moment. They may also assist subordinates to yield to the inclination to let decisions be made by those above him. Everyone can't effectively deal with both tactics and strategy at the same time. Strategy is the more important and is the province of the general management. His purpose may best be served by keeping him out of the on-line, real-time flow of data.

You know, all developments do not come automatically through analysis of a flow of past data. I don't suppose Edison's idea for the electric lamp came through a focus on a flow of data. He thought of the idea based on other observations and used data only in the refinement of his idea to avoid past mistakes. Too great a concern for data as the source of wisdom can be an impediment to imagination and innovation—which are what we expect from our managers.

I am far from a skeptic regarding computers but I am a realist. Successful installations begin with a cold hard look at the purpose—a search for a better way. Don't worry too much about the hardware, for they will come up with an even better machine while you are defining your objectives. The application of a computer requires the most careful analysis of the components of a problem and extremely clear thinking on what is required to get a certain result. What a shame if such analysis does not lead to questioning the purpose, need, and approach to dealing with each element.

ROLE OF FINANCIAL EXECUTIVES

What effect is all this development in operations research-management science and computers having on the financial executive? I have made no survey and have no statistics to present—only observations. It would seem to be clearly too early for anyone to have conclusions—only speculation is in order at this point and there is plenty of that going on.

Professor Thomas L. Whisler at the University of Chicago has followed developments and feels that the big changes are yet to come and when they do they will largely come at the managerial level—and that includes the financial executive. So far he sees a flattering of the organization structure—some areas are combined and reshuffled, reducing the tiers in the structure and the number of managerial positions. At the same time he senses a recentralization of control. He sees the manager's job in two parts: (1) computation and evaluation of information, weighing alternatives, and making choices and (2) communication with customers, fellow managers, and the like, including, now, communications with the computer. The impact of the computer has an effect largely on the first, or computational phase, permitting more time for the communications phase but not necessarily reducing the importance of the job as a whole. He also observes that chief executives are beginning to recognize the power of the computer and its effect and are less prone to delegate responsibility for it.

Professor Whisler came close to the mark when he also observed that in companies where the management science-computer impact has resulted in reorganizations, the managers who survived and thrived were those who early saw the advantages of the new systems and new organizations. This has, it would seem to me, a clear message for the financial executive. Much of the opportunity is for those who take a positive view, get in the act, and make a contribution.

The financial executive clearly had the inside track at the beginning—not so much on the OR-management side of things as these people frequently come into the picture by other sponsorship. But on the computer side the financial executive was almost always the one sought out by the equipment manufacturer's representative, as he was the one who traditionally handled numbers equipment. In some companies the financial executive took the initiative and has kept it. In a great number of other cases he has not.

I really don't know a general rule for stating to whom the management science and computer areas rightfully belong, if right has anything to do with it. Under the theories of organization that I was brought up on, the financial executive was the one, other than the chief executive, who was supposed to be in a position to have an over-all view of corporate affairs. Accounting was supposed to be all-pervasive and to cover all areas in the corporation. The financial executive position was the one that was epitomized by the term "functional control" and he

was supposed to control, functionally, the numbers game wherever it was played.

Lately, this whole concept is getting rather badly bent. We find corporate directors of planning; I thought this was what chief executives were supposed to do personally, without much delegation, but in consort with the financial executive—the only other fellow with an overview of the corporation. We have vice presidents for administration. Who are they? Administrative functions used to be divided between the financial officer and the corporate secretary, depending on how much time the secretary had left over from his legal and shareholder work. Now we find vice presidents for information; I thought information was the merchandise of the treasurer and controller. We also see data processing equipment under the direct jurisdiction of marketing and production units, with little or no influence exercised from the financial area.

Some observers propose a vice president for information. One writer in the May 1964 *Financial Executive* (Mr. Gerald G. Fisch) proposes a vice president for information—and I quote: "Who is in charge of all aspects of information generating, processing, and dissemination? It must be his responsibility to determine *how* management information needs can best be met. Furthermore, he must have the intellectual capacity to know *what* types of analysis performed on various data will produce information of value to the company—whether the executives in charge of the various functions realize it or not." (This is a description of more than a service bureau—this author must have been told, as I was, to make his material controversial.)

All of you are aware of this churning in the organizational aspects of where the management sciences and the computer fit into the organization structure. Some people do not realize that organization planning is as much an art as it is a science. The perfect structure for one does not work for another. There are some principles to be sure, but given a structure, sound in principle, you must then deal with people. The purist in organization says you set up the right structure and then staff it—but the pragmatist observes that we already have people on our payroll who don't quite fit, so he bends the structure here and there. It is getting bent often nowadays when the financial officer doesn't quite fit what management views as progress.

The place of an OR group in an organization structure depends on a lot of things in a given instance, such as the group's purpose, the

subject matter to be dealt with, and the kind of people who staff it. Probably the key is to put it where the group will have the right environment to do an effective job; where it will be encouraged; where pains will be taken to understand what the OR'er wants to do and to understand and communicate what he has done. The executive to whom such group might report could as well be the financial officer as anyone else if *he* is right for the task.

The same considerations apply for the computer. I see good and bad installations, wherever they may be in the organization structure. I also see data processing being taken out of the financial area, rarely if ever to return. At least this is the indication so far. Again, whether or not the financial group regains control depends more on the financial executive than on some universal law or principle.

The financial executive can, and I have seen it done, assert his "right" to the information and management-science function. The Financial Executives Institute can attempt to assist by proclaiming this "right." None of this will do much good—really. In the last analysis it is up to the man. Has he made a real contribution to his company's success? Has he been as concerned for what the numbers mean as for what the numbers are? Has he been willing to innovate and take the lead in innovation, and very important, has he been able to achieve recognition by the engineers, production and marketing man, and the head man that he is their kind of person and understands their problem? You know—financial people—and I mean all of us—have been a part of some very poor public relations that are still with us. The March 7 *Business Week* has an ad for McGraw-Hill Publications showing a full-page picture of the controller wearing a big frown and standing at the conference table with about a hundred feet of tab run spread out before him. The caption reads, "Four questions to ask your controller when he says advertising looks too expensive on his cost sheets." And it goes on to lecture the controller on the facts of advertising life. Shades of Charles Dickens—no high stool, but a conference table; no leather-bound ledger, but a tab run; no green eyeshade, but a frown. (The frown was always there but at least the eyeshade hid it.) We aren't really like that, are we? At least not all of us all the time.