Making Work Productive

An Essay on Work and Work Control Systems

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Introduction

Practitioners and theorists alike share an interest in the productivity of work. In this paper, a systems-based model that has proved useful in efforts aimed at making work more productive is presented and discussed. It is not a model of human behavior or human performance; its focus is work, not the people who do it.

Work and Systems Theory

"Work," wrote Peter Drucker (1973), "is both noun and verb (p.168)." As a verb, it tends to be associated with human activity in the workplace, with workers and with working. However, work is also accomplished by machines and by human beings in interaction with machines. It is important to distinguish among work, worker, and working, no matter who or what does it, because it is work, not working or workers that must be made productive.

As a noun, Drucker noted that work is a process and it has a result. Moreover, the result of work exists apart from the worker and from working. A cabinet exists apart from the cabinetmaker and cabinet making. A sale exists apart from the seller and the buyer and from buying and selling. And a decision exists apart from the person who makes it and the process of making it.

In essence, the distinction between the result of work and the activity that produces it is the same distinction Gilbert (1974) makes when he differentiates between an "accomplishment" and the behavior that produces it. It is the separation of the result of work from the activity of doing it that makes systems theory well-suited for analyzing work because this separation makes possible the treatment of work in terms of inputs, processes, and outputs.

Work Systems: Input-Process-Output

The input-process-output formulation is perhaps the best-known aspect of systems theory. Basically, it states that a system transforms inputs into outputs. In a shop where custom cabinets are made, for example, one can identify production inputs such as wood, hardware, stain, and other items that are discernible in the end product. Working in such a shop includes activities such as planing, joining, squaring, gluing, staining and sanding. The outputs, of course, are finished cabinets. The conventional manner of displaying inputs, processes, and outputs is shown in Figure 1.

Figure 1 - The Input-Process-Output (IPO) Model

For reasons that will be made clear, it is useful to depict a work-and-work-control system in a somewhat different manner.

The model shown in Figure 2 is recognizably an adaptation of the more conventional systems model in that it shows inputs and outputs. Yet, it is different in that it depicts the processor as well as the process. It is also different in that it includes a controller and two feedback loops. (Strictly speaking, one of these two is a "feed forward" loop.) Although this model includes a work and a work-control subsystem, from this point forward it will be referred to simply as a work system.

A Word about Processes and Processors

"Process." This frequently used but rarely defined term is really nothing more than a label for the interactions between a system's input and the system's processor. The conversion of inputs to outputs results from these interactions. In Figure 2, the interactions between input and processor are depicted using the electro-mechanical computing symbol for a differentiator-integrator (an 'X' within a circle). This same symbol is used in both feedback loops. Provision is also made for supplying a label for the interaction.

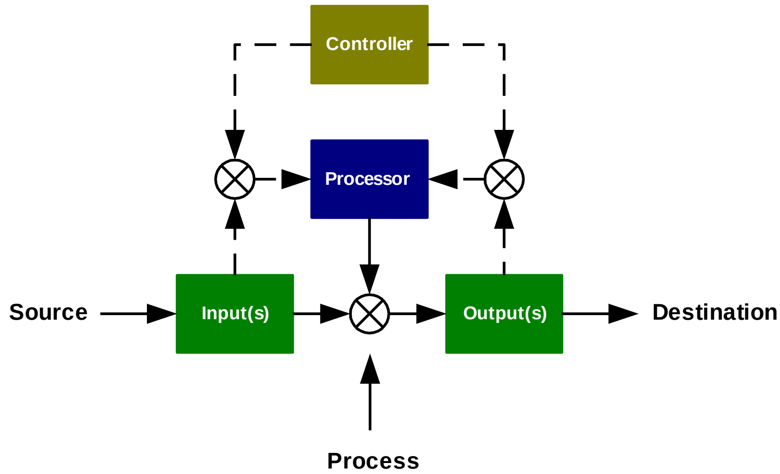

Figure 2 - A Work and Work Control System

At the "macro," or most general level of analysis, an entire organization can be considered as a single processor. At the "micro" or most specific level of analysis, a human being or a machine can be viewed as the processor, and the process itself could consist of one or more steps in a task or procedure. There are, of course, varying levels of analysis between these two extremes (e.g., unit and departmental analyses).

In the example of the cabinet-making shop, cabinets result from processes such as planing, joining, gluing, clamping, assembling, sanding, staining, and finishing. These processes are labels for interactions between and among inputs such as the wood, glue, hardware, stain, and the cabinetmaker who uses tools such as saws, planers, joiners, clamps, and sandpaper. The term "processor," then, refers not simply to the cabinetmaker but to the tools and equipment used as well.

In Figure 2, the structure of the work subsystem consists of the input, the processor, the interactions between the two (the "process"), and the resultant output. The structure of the work control subsystem consists of the controller, which provides reference conditions, or "referents," and the measurement, communication, and comparison mechanisms that provide feedback.

There are two reasons why the model in Figure 2 depicts the processor instead of the usual box labeled "process." One reason is to be clear about the true nature of the interactions labeled "process." The second reason is to more clearly illustrate the way in which control is exercised in a work system.

Control: Definition, Purpose, and Function

"Control," as Drucker (1973) so sagely observed, "is always against some standard." William Powers (1973), in his eloquent and erudite examination of human behavior from a systems perspective, referred to the standards used for control purposes as "reference conditions." The terms "standards" and "reference conditions" are used interchangeably in this chapter to denote requirements or criteria that must be met.

"Control," like work, is both noun and verb. Control as a verb refers to actions aimed at ensuring inputs and outputs of a certain quantity and quality, not just to actions aimed at directing or manipulating activity. The cabinetmaker, for instance, regularly measures the cabinet as it is being built, comparing its actual dimensions against those specified in a plan or drawing, and adjusting work activities so as to ensure that the end product conforms to specifications.

Control as a noun refers to the means used to measure actual conditions (what is), compare them with reference conditions (what should be), and to take appropriate action (close the gap). (The rather obvious connection of control, as it has just been defined, to problem solving will be explored shortly.)

The purpose of control in a work system is to reduce the difference between the input at two points in time: The first of these is as the input exists at the beginning of the work process; the second is as the input exists at the end of the work process when that same input, suitably altered, will be called the output. This output then becomes an input to some other system.

This last point, that an output then becomes input, is of critical importance to the issue of control. Generally speaking, the reference conditions, or control criteria, for a production system's output should be derived from a study of the input reference conditions or requirements of the system for which that output is bound.

To control work, one must have controls for its initiation, its execution, and its termination. The fewer in number and the simpler the nature of the controls, the better. (More on this later.) For workers, these three control points can be expressed as questions: How do I know to begin? How do I know I'm making progress? How do I know I've completed the task? Initiation, execution, and completion, these three stages mark all work other than continuous processing.

The work of a work system is completed when the output meets certain criteria, not when specified activities have been carried out. Progress is signaled by gradual or incremental changes to the input on its way to becoming the output, not by the completion of this or that activity. Work is begun when there is a requirement to produce the output, the processor is in a state of readiness, and the input required to produce it is present in sufficient quantity and acceptable quality.

Control in a work system is exercised as follows: The actual condition of an input or output is compared with the reference conditions for the input or output. Any difference between the two constitutes an error signal, which is sent to the processor. In turn, the interactions between the processor and the input are adjusted so that changes in the output reduce this error signal to zero (plus or minus some tolerance). The controller supplies reference conditions. Measurement provides information about actual conditions. Communication provides for comparison of the two.

Troubleshooting Work Systems

One important use of this model is as a guide to diagnosis, a framework from which to troubleshoot poorly performing work systems. The requirement for diagnosis is signaled by faulty output. The structure of a work system, as shown in Figure 2, suggests that a faulty output, or result, is attributable to a limited number of factors.

The inputs or resources might be faulty; in which case the initiation reference conditions should forestall task commencement. The output reference conditions might be absent or inadequate, in which case the outputs or results will vary. An all too common situation is to find the presence of standards for output volume but none for output quality, even though quality is generally the more important of the two. Measurement of the actual conditions might not be performed or its results not fed back for comparison with the reference conditions. In other words, the feedback loop might be open. Again, output will vary. Finally, the tools used or the routines carried out by the processor might be insufficient or faulty.

Control as Problem Finding and Problem Solving

One can hardly overlook the similarities between the earlier description of control as an error-reduction process and needs assessment or problem finding as described by Kaufman (1970) or problem solving as defined by Kepner and Tregoe (1965). Indeed, one way of viewing control and controls is to see them as a pre-programmed set of problem-finding and problem-solving routines. There is a connection here to Jacobs' view of the HRD professional as organizational problem solver.

Jacobs (1989), citing Goldstein (1980), asserts that the general purpose of HRD "is to foster a desired change in the performance of a defined audience in an on-the-job environment." Intervention is implied. If "performance" refers to the results associated with work and working, then it follows that the interventions of HRD professionals must address the issue of how the performance in question is controlled. In turn, if control is essentially a set of problem-finding and problem-solving routines, this means that the work of HRD professionals not only centers on the problem-finding and problem-solving activities of others but must itself consist of these same two activities. To deny this would be to exempt the work of HRD professionals from the same basic principles of control as apply to other forms of work.

More important, the work of most people consists of problem-finding and problem-solving processes. Recurring, repetitive routines of a simple manual nature have all but disappeared from work in the United States (as will be discussed shortly). But, recurring, repetitive routines of a mental nature have not. One such routine is the work of problem finding and problem solving, which can be studied and analyzed apart from the specific inputs and outputs associated with this or that occupation.

Consider, for example, the physician, the manager, and the technician. The same basic process underlies the work of all three. The physician calls it "diagnosis," the manager refers to it as "problem-solving," and the technician knows it as "troubleshooting." Yet, fundamentally, it is the same work and the same principles of work control apply to all three.

Control and Countercontrol

Employees, as workers, often function as processors in work systems. Employees also can be viewed as autonomous open systems, not merely as automatons in someone else's scheme of things. Their roles as processors, then, are in no small way colored by the fact that they fulfill these roles as independent entities carrying out their own transactions and operating in accordance with their own reference conditions. These individual reference conditions can and do come into conflict with the reference conditions that management attempts to impose. As Skinner (1974) pointed out, "Those who are so controlled then take action." He added, "In other words, they oppose control with countercontrol (p.190)."

Two of the most basic control mechanisms in organizations are budgets and the payroll system. "Padding" of budgets is too well known a practice to warrant review here. Cheating on time cards is another. However, countercontrol can take much more subtle forms, as the following example will illustrate.

A sales manager, puzzled by a seemingly senseless pattern of sick and vacation days being taken by his sales crew, asked a consultant who was studying the work of the sales crew to investigate. What the consultant found was that the sales representatives were "managing" the payroll system to better balance their personal cash flow situations. Here's how it worked.

The sales representatives were paid based on their commissions from sales. To allow for clearing and verification of the sale, commissions were paid four weeks later. Payments for sick days and vacation time, however, were made the week following the time off. More important, these payments were based on the sales representative's average level of sales. Three weeks after a week in which a sales representative's sales were below his or her average (the results of which would show up in the next week's paycheck), the sales representative would take sick days or vacation time and thus boost the following week's paycheck.

The preceding example prompts an aside: Analysts who are interested in studying the work performed by human beings would do well to remember that they are dealing with intelligent, reasoning, analytical human beings, not with objects bearing the label "employees," or "processors," or even "open systems."

The earlier comment that controls should be simple in nature and few in number is intended to remind those who build controls and control systems that if they make the control system too complex, it will be susceptible to manipulation and countercontrol in ways that are difficult to detect.

The Control of Work and the Shift to Knowledge Work

If it seems that the issue of control is being emphasized, there is ample reason for doing so. Between 1920 and 1980, a fundamental shift occurred in the nature of work itself. Work, for workers, ceased being primarily a materials-based process and became one that is primarily an information and knowledge-based process.

Knowledge work is done using one's mind, not one's muscles. Its primary tools are language and logic, not lathes. Between 1920 and 1980, as working became more and more a mental activity instead of a manual one, the activity of working literally slipped out of sight, making work difficult to study and working impossible to supervise. For now, at least, the locus of control over work and working has shifted from management to the worker.

The reference conditions that control work and working are part of the individual worker's frame of reference. Often, these reference conditions are known only to the worker. This is especially true in the case of highly skilled, highly specialized professionals. Further, the reference conditions often vary from worker to worker. The situation today with respect to knowledge work is much the same as it was with respect to manual work when Frederick Winslow Taylor first began studying it more than one hundred years ago; namely, management has little firsthand knowledge of the work being accomplished or of what is involved in accomplishing it.

The reason the model shown in Figure 2 includes a controller is to emphasize the critical role reference conditions play in governing work. No claim is being made that one can peer inside the mind of the worker and see what goes on there; nor is any claim being made about the mind itself except as a construct. However, because the results of work exist apart from the worker, it is claimed that knowledge work can be studied in a systematic, scientific way, just as Taylor, Gantt, and the Gilbreths did with manual work. It also is claimed that much of the work currently escaping serious analysis because it bears the label "judgment" or "knowledge work" is really nothing more than an undocumented algorithm; complex, perhaps, but an algorithm nonetheless.

The key to studying knowledge work and making it productive lies in focusing on the work, not the worker. Much of Taylor's success stemmed from improvements to the work itself and to the tools and equipment used to do it. Much of the success of that area of HRD practice known as "human performance technology" stems from precisely the same kinds of improvements.

An Example of the Proper Focus

An analysis of the work of financial aid assistants undertaken at the Educational Testing Service in Princeton, New Jersey, illustrates the value of focusing on the work itself.

After three months of intensive effort, accomplished mostly by people who were experts in the work being studied, the tasks associated with deciding what to do with documents suspended from automated processing had been documented in the form of 108 algorithms.

These 108 algorithms contained 769 discrete, unambiguous, binary decisions and 607 detailed action steps. The algorithms were supplemented by narrative descriptions and then packaged as a tabbed and indexed set of job aids to be used at the financial aid assistants' workstations. The job aids also constituted the primary tool used in training new employees and in communicating new error resolution routines to existing employees. For the first time, the reference conditions that governed the work had been captured, standardized, encoded in the algorithms and narratives, and then communicated to the financial aid assistants.

By studying the work of the financial aid assistants, new tools were developed (the algorithms and the job aids) and, as will be explained later, another tool, a computer program, was modified. In turn, a sizable improvement in productivity was realized, along with reductions in training time and costs, and improved hiring practices. It is worth mentioning that not once during the course of this project was its focus placed on the worker.

An Example of the Wrong Focus

In contrast, a classic case of the failure to systematically study the work itself in order to identify, communicate, and encourage adoption of the referents that should govern the work occurred several years ago in pre-divestiture AT&T.

A study of the jobs of first-level and second-level managers was conducted by AT&T's HRD department. The results of the study, which was based primarily on data collected from interviewing and surveying third-level and fourth-level managers, indicated that the first-level and second-level managers did not possess good writing skills. In this study, the focus was clearly on working and on the worker.

AT&T spent several million dollars purchasing and delivering training in an effort to improve the writing skills of its first-level and second-level managers. About a year later, a follow-up study was conducted. The results of this study were puzzling and problematic for the HRD department: the third-level and fourth-level managers asserted that matters had gotten worse, not better.

Had the study identified and traced the flow of the outputs of the first-level and second-level managers' writing activities, it would have established that, for the most part, these outputs consisted of correspondence and memoranda that these managers prepared for signature by their bosses, the third-level and fourth-level managers.

The reference conditions governing the acceptability of these outputs were unique to the managers for whom the documents were prepared, that is, the reference conditions varied from boss to boss. In those cases where the managers who prepared memoranda and correspondence had not determined their boss's preferences regarding written documents, the documents were apt to require revisions or simply to be rejected out of hand. Predictably enough, the boss would conclude that the first-level or second-level manager didn't know how to write.

The money spent on training these first-level and second-level managers how to write probably would have been better spent on developing ways for them to identify the reference conditions their bosses used to evaluate correspondence and memoranda (e.g., by going to the files to study documents previously signed, and by interviewing the boss' secretary regarding stylistic and substantive preferences). Some of the money would have been even better spent on teaching the analysts how to study work.

Instead, the first-level and second-level managers attended training where they were presented with models and reference conditions for writing that were totally unrelated to the models and reference conditions used by their bosses. When the first-level and second-level managers began writing as they had been trained to do, even more of the documents they produced for their bosses were rejected.

Analysis: Where to Begin and Why

The primary use for the model shown in Figure 2 is as a guide to diagnosis or analysis. Whether as a prelude to intervention or simply as a means of gaining understanding, the analysis of a work system should begin with its outputs, not its inputs. One risk in beginning analysis with the inputs is that, because there are usually many of them, the analysis will branch out in a number of different directions, making the analysis not only an unwieldy task, but one that offers little insight into when and where it will conclude. In some cases, beginning analysis with inputs presents a far greater risk, as the following example illustrates.

While in the course of carrying out a project for a client, a consultant was asked to take a brief look at the firm's complaint handling function. Complaints came in by correspondence and by telephone. The costs of the correspondence unit were three times those of the telephone operation. The consultant was asked to see if he could spot any obvious and easily implemented ways of making the correspondence unit more productive. He did and it was.

The correspondence unit was shut down. Instead of attempting to respond to complaint letters with more letters and thus triggering an even greater and more costly correspondence workload, complaints received by mail were answered with a preprinted postcard, asking the person to call a toll-free number and speak with a customer service representative. In effect, complaints sent in by mail were converted to complaints made by telephone.

The preceding example prompts an aside. Below are two very fundamental rules regarding improving the productivity of work:

- Rule 1: If you have to do it, do it once.

- Rule 2: Don't do it at all if you don't have to.

Had the analysis in the previous example begun with inputs, it might have found ways of making the work of the correspondence unit more productive; that is, it would have increased the efficiency of work that should not have been performed at all. Instead, the analysis began with outputs and a few basic questions: What are the outputs of this unit? Where do they go? Why are they produced? How do they make their way back to the organization? What happens then?

Challenging the Work Itself

Another example, from the earlier mentioned project at the Educational Testing Service, follows. This example will highlight the importance of challenging the work itself, that is, of checking to see if the work is necessary.

The work of the financial aid assistants consisted of (1) determining why documents had been suspended from automated processing, (2) deciding how to correct or modify the data, and (3) submitting these corrections to data entry for reentry and additional automated processing. As it turned out, the task of determining why the document had been suspended was unnecessary.

The documents were suspended from the automated processing stream because the data entered from them had failed certain edits in the computer program's logic. Upon suspension, a correction document containing an error message was printed. Many of the error messages could be linked to more than one edit. Thus, a given error message might occur for more than one reason, some for as many as five. The first task facing the financial aid assistant was to identify the specific edit that had caused the suspension. The computer program "knew" which edit the document had failed yet the printed error message did not indicate the source of the problem. It proved a simple matter to modify the error-message routine in the program to indicate the reason for the message on the printout, thus eliminating the first step of the financial aid assistants' task.

Of course, eliminating the work itself isn't always an option. In many cases, the analysis must proceed. To get quickly to the heart of the matter, the analyst must begin with outputs.

Getting Quickly to the Heart of the Matter

Suppose, for example, one wishes to analyze the work of an insurance underwriter to determine how the underwriting class of an insurance applicant is assigned.

If the analysis begins with inputs, one readily establishes that these consist of information about the applicant's age, sex, health, citizenship, the amount of premium involved, and the face amount of the policy for which the application was submitted. Then, if one asks an underwriter to explain the process whereby an underwriting class is assigned to an applicant, one encounters a maze of decision-making factors that seems capable of infinite expansion and that will take forever to unravel.

But, if one begins with the possible outputs, with the range of underwriting classes that can be assigned, one quickly establishes finite boundaries for the analysis. One learns that there are eight standard and sixteen substandard underwriting classes. This count is somewhat inflated because it includes classes that are based on simple, unambiguous differences between males and females and between smokers and non-smokers. The count of 24 underwriting classes quickly reduces to three: "simplified" and "medical," both of which are considered standard, and "rated," which is considered substandard.

One also learns that in the absence of any negative health information, the simplified and medical classes are determined by the applicant's age and the dollar amount of the premium and that the rated cases are the result of a "debiting" or scoring system used by the underwriter. At this point one will identify yet another outcome: The application might be declined. (Ultimately, all an underwriter can do is accept, decline, or make a counter-offer.)

In summary, beginning one's analysis of a work system by studying the outputs instead of the inputs helps one get more quickly to the heart of the matter. In the case just described, the "heart of the matter" is the scoring system used by underwriters to assign rated or substandard underwriting classes.

A Caution against "Sloppy Systems Thinking"

Great care must be exercised in identifying inputs and outputs, especially in tracing out the relationships between the two. Of particular importance is knowing when to focus on physical, or material flows; when to focus on information flows; and when to focus on the linkages between the two.

In the case of an insurance company, for instance, it is tempting and even technically correct to think of premiums and applications for insurance as inputs and insurance policies as outputs. However, it is not correct to think of applications or premiums as being converted into policies. Instead, information about the applicant and the premium serves as input to the processes whereby decisions are made to accept an applicant and, subsequently, issue a policy.

A claim form submitted to a health insurer can be readily traced from receipt to archive. Doing this tells one something about document flow and perhaps about document control. However, if one wishes to analyze the decision to pay or deny the claim, studying the physical flow of claims forms will not reveal a great deal.

A claim could be submitted for any one or more of several thousand services provided by physicians. Factors affecting payment of the claim include subscriber eligibility, patient eligibility, provider eligibility, service coverages, maximums, coordination of benefits with other providers, and the diagnosis underlying the service provided, to name but a few. Yet, as regards payment of a claim, there are only two possible payment outcomes: The claim is paid or it is not. If it is paid, it is paid in full or it is paid in part. If it is not paid, it is denied as an invalid claim, or it is deemed valid but no payment is to be made (as is the case when the maximum coverage for a particular service has been reached). Oh yes, there is one other possible outcome: The claim could be lost.

From this limited set of outcomes, one can work backward to identify the reference conditions and the logical processes that comprise the work of "adjudicating" a claim. This work is indeed algorithmic in nature. It can be, and has been, subjected to the same kinds of analyses as were applied to the work of the financial aid assistants at Educational Testing Service.

Redundant Work Systems

To this point, the discussion has centered on what might be considered a single work system at the individual, or micro-level of analysis. In most organizations, work is accomplished by many interrelated and interdependent work systems. Thus, there might be opportunity for improving the productivity of work owing to the potential for redundancy; that is, there might be situations wherein the same work is being accomplished in more than one system.

The products marketed by an insurance company where I was once employed were supported by three basic types of computer systems. The actuarial department used one called "the actuarial system" to develop and price products. The marketing department used another called the "sales illustration system" to demonstrate various investment returns, policy values, and the like. And the service department used one called the "policy administration system" to support new business and customer service functions.

All three computer systems relied on many of what are essentially the same calculation routines. Yet, for several years, these routines were developed independently of one another. The actuaries developed one set of calculation routines in FORTRAN for use in their mainframe actuarial system. The mainframe programming staff developed another set of calculation routines in COBOL for the policy administration system. And, yet a third set of calculation routines was developed in BASIC for use in the microcomputer illustration system.

Naturally, the same programming "nuts" were being "cracked" in three different places, generally in three different ways, by three different sets of programmers. This costly duplication of effort was eliminated as a result of an effort to develop shared calculation routines usable by all three systems.

Transactions: System and Environment

Katz and Kahn (1966), citing the genius of F. H. Allport, define a social system as "a cycle of events." Such systems are characterized not just by the input-process-output formulation, but also by transactions with their environment, by the exchange of outputs for new inputs in order to close and reinitiate the cycle of events that defines the system. The transactional aspect of open systems is shown in Figure 3.

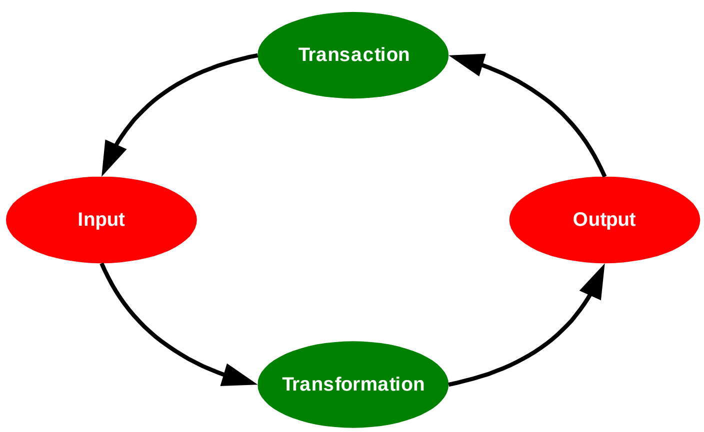

Figure 3 - A System as A Cycle of Events

Katz and Kahn's definition of a system is event-oriented and stands in contrast to definitions that are thing-oriented and define a system as a "collection of components." Both perspectives are useful.

The production subsystem of the cabinet-making shop can be analyzed from a thing-oriented systems perspective. Its sales and decision-making subsystems, however, are event-oriented. Most organizations have processes that are thing-oriented and those that are event-oriented. One can trace physical flows in thing-oriented processes and learn a great deal about outputs and how they are produced. As regards event-oriented processes, however, one must trace the flows of information and the events this information enables, triggers, and controls.

Organizations, as open systems, must engage in transactions with other systems. The cabinet-making shop, for example, must have some means of exchanging the outputs of its production for new inputs. Thus, no matter how simple or informal, a business organization must have marketing, sales, and distribution subsystems. Bartering is rare now and a company's products are usually exchanged for money.

An organization must also have some means of exchanging its money for more materials, equipment, facilities, and labor with which to manufacture additional products; it must have purchasing, plant management, and personnel subsystems. Tracking the flow of money and the surpluses and shortages arising from that flow, requires two other organizational subsystems, finance, and accounting. It seems obvious, then, that the internal structure of an organization reflects its external environment. More to the point, understanding the internal structure of an organization necessitates studying its external environment.

Studying the transactional aspects of organizations and individuals as open systems reveals that not all transactions are concerned with exchanging production outputs for money, or with exchanging money for new production inputs. Some inputs serve only to maintain the system. It follows that there is work associated with the maintenance of the organization.
One such maintenance input is the granting of legal status to the organization on an ongoing basis. Without it, the organization would have to cease operations. In many companies, there is work associated with a function called "compliance." This work exists to ensure that a company's practices are consistent with various laws, rules, and regulations so that it might continue doing business.

For the purposes of analyzing work, however, the distinctions between production and maintenance inputs or between transformational or transactional processes are of no concern here. Work is work, whether one is dealing with clerk, technician, manager, or physician. The techniques of analyzing work are indifferent to class distinctions of a social or socio-economic nature.

Eliminating Non-Productive Time

Implicit in the view of a system as a "cycle of events" is the notion of time. Given that the fundamental task of managing work is one of concentrating and channeling energy along productive lines, one of the simplest, and generally quickest, ways of increasing the productivity of work is to identify and eliminate time not spent in that cycle of events known as work. An example from Citicorp's travelers checks operation will illustrate.

In the course of documenting the work of travelers checks claims examiners (the people who process claims for lost or stolen travelers checks), it was decided to examine the time spent at and away from the workstation. Roughly 60 percent of the examiners' time was spent at the workstation and 40 percent was spent away from it. Of the 40 percent spent away from the work station, half, or 20 percent of the examiners' total time, was spent standing in line at the copy machine. This had not always been the case.

The copy machine was new. It was a large one, capable of high-volume runs, and it had been purchased because the cost per copy was lower than for the previously existing configuration of many small machines scattered around the facility. However, when the cost of the "waiting time" of the examiners was factored in, it became clear that returning to the previous configuration would be more cost-effective. The small copy machines were put back in place, and considerable attention was paid to their placement so as to reduce travel time as well as waiting time.

Another sizable portion of the examiners' time was spent traveling to and from the supervisor's desk and waiting there for approval of resolved claims. This travel time was eliminated by increasing the dollar-limit of cases could resolve without requiring supervisory review and approval.

Change, Adaptation, and Intervention

It is not enough for an organization to be able to exchange its outputs for new inputs today; it must also be able to do so tomorrow and into the future. Moreover, it is often the case that what can be produced and exchanged today can't be exchanged in the future, leading to changes in what is produced or how it is produced or, possibly, to the demise of the organization. The requirement to "adapt or die" is as true for organizations as it is for individuals. Change and adaptation are the laws and lessons of survival, and they call for intervention.

The Context for Intervention: The Organization as A System

When intervening in work systems, one must consider the larger context in which that system is embedded. Kelly (1982), in his effort to link the analysis of work with the design of jobs and work performance, cites the sociotechnical view first set forth by Trist and Bamforth (1951), and subsequently elaborated upon by Emery (1959) and Rice (1958). The general gist of sociotechnical systems theory is that two primary dimensions of an organization must be integrated. One, the social dimension, has to do with the needs of people. The other, the technical dimension, has to do with the work itself. Similar constructs can be found in the writing of Blake and Mouton (1964) regarding managerial style and that of Hersey and Blanchard (1977) regarding organizational behavior.

Curiously, the two dimensions of organizations receiving the least amount of attention in treatments of organizations as sociotechnical systems are two of the most important: politics, and economics. This gap in subject matter might explain why so many interventions fail or fall short of expectations. Kelly notes that Emery (1959) and Trist et al. (1963) argued against including a financial dimension, saying that it was best treated as a measure of effectiveness. Few raise the issue of politics. Yet, politics and economics are organizational realities and extremely relevant to those who intervene in the work-related affairs of people and organizations.

The Four Dimensions of Intervention

It is useful to adopt a view of organizations-as-systems that integrates not only their social and technical aspects but also their political and financial ones. In Figure 4, the social and political aspects form one axis and the technical and financial form the other. This yields a diagram showing four dimensions of intervention.

The social-technical dimension is the focal point for efforts relating to work analysis, job design, work organization, typical human relations efforts, and the day-to-day task of managing. By and large, this dimension of organizations focuses on the work itself, the primary subject of this chapter.

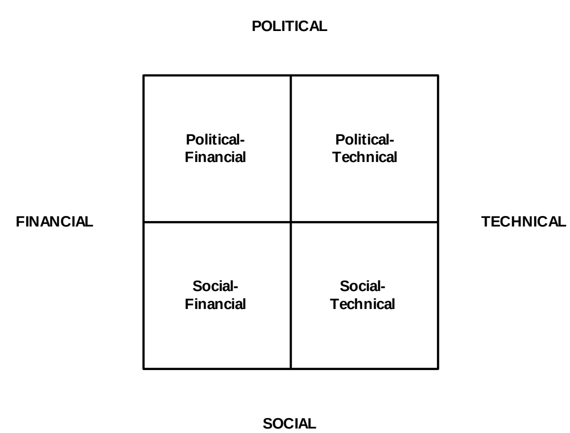

Figure 4 - The Dimensions of Intervention

The social-financial dimension is concerned with what March and Simon (1958) termed the "contributions-inducements" relationship between an organization and its members, and what Baldamus (1961) called the "wage-effort bargain." A key issue here is compensation, especially production incentives and performance bonuses. Another is benefits. Perhaps the paramount issue is one of attracting and retaining people. This dimension, then, includes issues related to personal and career development.

A third dimension, technical-political, relates to the requirement to divide and coordinate the work of the organization and to maintain a balance of power in so doing. The division and coordination of work and functions carries with it a corresponding distribution of technology, people, resources, "turf," and authority. These are all sources of power and influence, and the balance among them must be managed. The political reality here is that organizations must be governed as well as managed.

The fourth and last dimension, financial-political, is perhaps the most important. Three dominant issues here are the control of resources, the relationship between leadership and legal authority, and market pressures; in short, with running the business. This dimension is of primary concern to chief executive officers and boards of directors. Among the tools for change in the financial-political dimension are leadership and authority, and authority's concomitant control of resources.

Whatever authority is exercised or delegated within organizations is derived from the organization’s status as a legal entity. This status is conferred by "the state," which derives its authority from the consent of the governed. In turn, the consent of the governed is predicated upon a perception that those who govern are fit to do so. In a word, the ability to govern rests squarely on the ability to lead, on leadership. This is true within organizations as well as without. Organizations lacking in leadership don’t change and adapt, they drift; and, unless a firm hand takes the helm, they founder on the rocks and shoals of happenstance.

Assuming adequate leadership, the primary tool for change is the authority to control resources. Nothing happens in an organization unless the effort is staffed and funded (officially or unofficially). However, the allocation of resources and restrictions placed on their utilization are not so much prime determinants of what will get accomplished as they are of what won’t get accomplished. The control of resources provides a form of veto power, and steering the organization in the right direction is often a matter of keeping it from going in the wrong direction.

All organizations, profit-oriented or not, are economic entities. Inputs, in the form of money or as the result of an exchange for money, are essential to continued operation. All organizations, profit-oriented or not, have and are subject to pressure from their "markets." Typically, markets are thought of as consisting of customers, as outlets for production outputs. There are also capital markets, consisting of potential investors; labor markets, consisting of potential employees; and commodity markets from which are obtained new production inputs. Pressures on the organization for change and adaptation can arise from any or all of these.

Given that organizations as systems have social, political, technical, and financial dimensions or subsystems, all of which are interrelated, intervening in organizational processes is a complex task, one that taxes the ablest manager, executive, or consultant. The complexity of this task led Bowers (1973) to say, "The most fundamental thing we know about change is that it is indirect; that is, you don’t change it, you change something else and it changes as a result." Senge (1987) echoes this view when he says, "cause and effect in complex systems are often distant in time and space." The next few paragraphs partially illuminate this complexity.

System Players and System Thinkers

It has been said of organizations that they are playgrounds for adults. This is to say that people work out their "personal agendas" while at work. Some engage in power plays, caught up in a never-ending struggle for dominance. Some revel in political maneuvering for the sheer sake of the game. Some strive for professional or personal recognition or both. Some seek meaning from their work. Some try to run a business. Some merely try to make ends meet; they do their work, take their pay, and go home. Some are pawns, some are players, and some are observers. All, in one way or another, are "systems players"; that is, they use and are used by the organizations of which they are members and in which they spend the majority of their waking lives.

Although most people are "system players," few are "system thinkers." Not many people possess the breadth of experience, the inclination, the insight, and the know-how to address, balance, and integrate the social, political, technical, and financial dimensions of organizations. Yet, with few exceptions, successful intervention, especially on a company-wide basis, demands addressing all four dimensions.

The restructuring of work, for example, can disturb delicate balances of power and trigger opposition that has nothing to do with potential gains in productivity. Improving the productivity of work lowers labor costs, thus increasing profitability and perhaps occasioning the demand for higher wages. Business decisions to enter new markets can create the requirement for new technology, and importing new technology can disrupt both the formal and the informal organization. By the same token, social change can be "piggy-backed" on technological change, and technological change can be used deliberately as a way of forcing social change.

Therefore, when making work productive, it is not enough to study the work (social-technical) in a purely rational, analytical way to determine better methods or tools. One must also consider the financial incentives provided the workers (social-financial). One must consider issues related to the balance of power inherent in the division and coordination of work (technical-political). One must consider the validity of the work itself in light of market pressures for change. Finally, one must consider the backing an intervention will receive in terms of leadership, authority, and the control of resources (financial-political). One must play the system and its games.

Above all else, the practitioner who is interested in making work productive must consider that the quality of management and the productivity of work might or might not be of pressing concern in a given firm. On this score, no better statement has been made than the one by Frederick Winslow Taylor in *Shop Management* (1911b):

> "The second fact that has struck the writer as most noteworthy is that there is no apparent relation in many, if not most cases, between good shop management and the success or failure of the company, many unsuccessful companies having good shop management while the reverse is true of many which pay large dividends.
>
> We, however, who are primarily interested in the shop, are apt to forget that success, instead of hinging upon shop management, depends in many cases mainly upon other elements, namely—the location of the company, its financial strength and ability, the efficiency of its business and sales departments, its engineering ability, the superiority of its plant and equipment, or the protection afforded by patents, combination, location or other partial monopoly.
>
> And even in those cases in which the efficiency of shop management might play an important part it must be remembered that for success no company need be better organized than its competitors (p.19)."

The context for practitioners, then, regardless of their specialty, is an exceedingly complex one. Moreover, it is not one that is well mapped or well understood. But, systems theory, as a framework on which to hang the results of experimentation and trial-and-error learning, seems to offer the most promise of someday enabling systematic, reliable approaches to understanding, changing, and developing organizations. In the meantime, practitioners must make do with the insights gleaned from practice.

Insight: The Buying and Selling Transactions

The transactional aspects of open systems offer insights into long-standing practices. Take sales, for example. Consider Figure 5, where two systems are engaged in an age-old transaction called "buying" and "selling.

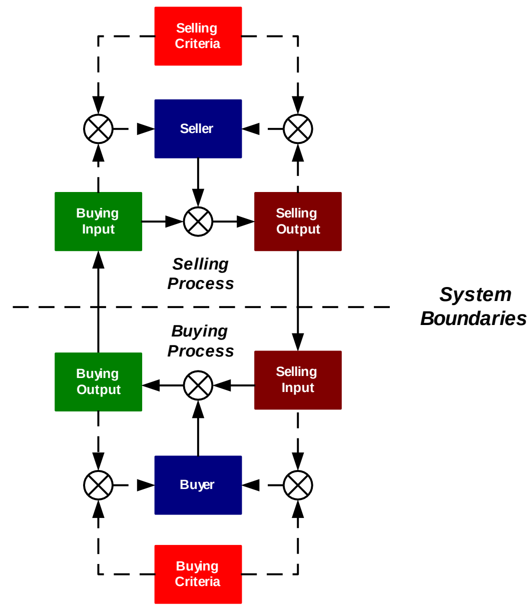

Figure 5 - Buying and Selling Systems

If one accepts the premise that reference conditions control outputs and processes, it follows that one task of the system engaged in selling is to favorably "position" its products in relation to the buying system's input requirements and to the criteria or reference conditions that govern the buying system's decision to buy. It also follows that a second task might be one of influencing the buying criteria themselves, that is, of suggesting to the customer the basis on which to decide.

A well-known case wherein the reference conditions (and "processors") that govern the buying decision were not dealt with adequately involves the Singer Company, which is best known for its sewing machines. Several years ago, Singer found itself with a very large distribution network: small stores all around the country. A decision was made to use this distribution network to sell a much broader range of products; namely, stereo equipment.

The strategy seemed to be sound. What Singer somehow failed to realize was that the customers who frequented its stores were women and, at that time, for the most part, men made the decision to buy stereo equipment. A simple look at the anticipated transaction upon which this costly strategy was predicated and implemented might have forestalled the effort. Or it might have resulted in a massive advertising campaign aimed at attracting the real buyer to the Singer stores. In either case, the buyer should have been identified.

Insight: Consequences and The Formation of Reference Conditions

One of the most significant insights to be gleaned from examining the transactional aspects of individuals as open systems is the insight into the relationship between the consequences of behavior and the formation of the individual's reference conditions.

In systems terms, the consequences of behavior are the perceived results of a transaction with the environment. Some of these consequences are contrived (e.g., praise and rewards, criticism and punishment) in an effort to "shape" behavior. Others are inherent in the work itself, for example, when a programmer compiles a program and it compiles or it doesn't, and if it compiles, it runs or it doesn't. (The pleasure derived from its running can far outweigh the pleasure derived from any compliments for a job well done.)

The reference conditions the organization's managers attempt to impose can and at least on occasion do conflict with those held by the individual. Consider a not too uncommon situation facing many salespeople. The sales manager is pressing the salespeople to sell Product A, the commission is higher on Product B, and the customer wants Product C. Consider next the range of reference conditions that might be operating in a salesperson in this situation: satisfy the boss, maximize personal income, and meet the customer's needs. An interesting problem, isn't it? Even more interesting is the fact that it falls to the salesperson to reconcile this conflict among reference conditions. Thus it is that the worker truly controls the work.

Insight: Reference Conditions, Attitudes, and Motivation

It is unfortunate that all too often the reference conditions that should govern work are not communicated to the worker. Even when these reference conditions are communicated, not much is done to foster their adoption. As a result, far too many people learn "the right way" to do things only as a result of continuous criticism. This is not feedback; rather, it is information about expected performance after the fact. Worse, owing to the punitive circumstances under which many people learn what is expected of them, other, less desirable and doubtless unintended perceptions are formed; for example, "This is a rotten place to work." "They don't know what they want." "I have no idea what's expected of me." "People are treated like dogs around here." And, worst of all: "Who cares."

The preceding sentiments express a subset of perceptions to which we normally apply the label "attitudes." They manifest themselves in ways we attribute to motivation. They stem from management practices developed in a time when work was mostly manual and control over the work was exercised by controlling the behavior of the worker. The focus of control was the worker and its aim was compliance. These practices persist. The old ways die hard, despite their painfully obvious inadequacy.

Insight: Future Directions

Now, owing to the shift to knowledge work, the focus of control must shift back to work itself and its aim must be that of eliciting contribution, not ensuring compliance. Although the locus of control of work has shifted from management to the worker, it can be shifted back. As in Taylor's day, the task facing management is once again one of studying the work itself, to control it and to make it productive. As Drucker (1968) writes, "To make knowledge work productive will be the great management task of this century, just as to make manual work productive was the great management task of the last century (p.290)."

And, just as when Taylor first set them forth (1911a), the four basic principles of scientific management still apply:

1. a scientific study of the work itself;
2. the scientific selection, training, and development of the worker;
3. harmonious cooperation between management and the worker; and,
4. the equal sharing of responsibility for the work between management and the worker.

The major difference between Taylor's approach then and the one we must take now is not one of general principles, it is instead one of method and technique. Because working has become an "invisible" activity, observation and industrial engineering techniques such as time-and-motion studies do not serve us well. Because working is now an "invisible" activity, the focus of control over work at the individual task level cannot ever again shift from the work to working and thence to the worker. In short, the target is no longer overt human behavior.

We must take aim at that marvelously complex construct of models, methods, logic, and language we call the mind. Training, development, and management must focus on identifying, communicating, and fostering the adoption of reference conditions that make work more productive. (Incidentally, the issues of who else might be taking aim at this target and for what purposes are worth pondering.) Work, especially knowledge work, must be made productive. Fortunately, it is possible, as a result of studying the work itself, to make work more productive. Systems theory offers a useful framework for doing so. It should be noted that systems theory does not provide a detailed set of methods and techniques for making work productive; rather, it provides a systematic and structured way of thinking. In this sense, it is a compass, not a map.

It should be kept uppermost in mind that it is work we wish to make productive, not working or the worker. Failure to keep this goal in mind will spawn productivity improvement efforts aimed at working and the worker. These will be met with resistance and contempt, and rightly so, for such efforts are themselves most unproductive. As was shown in two of the preceding examples, perhaps the worst outcome of all is that focusing on the worker or working can succeed in reinforcing work that should not be done at all.

A Final Note: A Shortcoming in Systems Thinking

Make no mistake about it, the great value of systems theory and systems thinking lies in their utility at all levels of abstraction. To learn to think of individuals, groups, organizations and even nations in systems terms leads ultimately to truly global thinking. To use a trite phrase, systems theory and systems thinking enable one "to see the big picture," to see events in context.

Perhaps more important than learning to apply systems theory and systems thinking is learning to recognize those situations to which they do not apply. Consider, for example, the global economic system. Focus on that portion of it labeled "business and commerce." If you consider the fact that we don't yet have interstellar trade, what emerges is the recognition that the global economic system is a closed system, not an open system.

The literature of systems theory is rich with concepts and constructs useful in studying and understanding open systems but, by and large, it consigns the subject of closed systems to the irrelevant. As a result, the economic systems engineers who will be assigned the task of building our global economic system don't have much of a theory-base on which to draw. For the foreseeable future, economics at the global level will find the subject of closed systems very relevant indeed. And, unless and until we beef up our theory base regarding closed systems as well as open ones, we are likely to find ourselves with a severe shortcoming in the usefulness of systems theory and systems thinking.

If systems theory is to be advanced, it must be advanced along closed systems lines as well as those of open systems. The "suprasystem" in which all companies, industries, and nations find themselves is, economically at least, a closed system and we have precious little theory to aid us in coming to grips with the problems that beset it.

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