

other, much in the same manner as several small processes may be parts of one large process.

To illustrate: in a transportation system the locomotive is considered a static element in contrast to the dynamic element of the materials conveyed, but the steam system which is a part of the locomotive designates its pipes and fixtures as static as against the dynamic element of the steam conveyed and delivered to the pistons. Therefore, within the static entity of one large process we may find a new balance of static and dynamic elements on a smaller scale.

Likewise, unfortunately, in a business process static and dynamic elements, although consistent in principle, cannot be considered catch-alls for all elements on a single level, but assume a special meaning in accordance with the scope of their application. Analyzing process in this way on the basis of its fundamentally opposed elements, static and dynamic, produces results of true values which ordinarily would remain obscure and permits treating the *effectiveness* of process on the basis of a single principle. Of the many respects in which the balance of static and dynamic elements may be determined, we limit ourselves to A. Organization, B. Uniform Load, C. Path and D. Construction.

A. *Organization.* An organization may be described as dividing the total required business effort into a number of parts, divisions and subdivisions. These divisions necessitate the additional effort of combining, connecting and coordinating the separated individual parts for an intelligent concert of action. This additional expense is the *static expense*.

It could be likened to the cement and mortar of a brick wall, except for the fact that it is not proportionate to the number of divisions made, or necessarily proportionate to the dynamic volume of work accomplished. The proportion of *static expense to dynamic volume* depends on the correctness of the divisions made and on the status of development.

The correctness of the divisions made in an organization—some call it the delegation of authority—is founded primarily on the original balance of organization and business problem, as a singleness of purpose and a clear intersection of the lines of interest reduce complications and avoid red tape. More specifically it is decided by the degree of clear separation between static and dynamic efforts. Sometimes these are entirely mixed in the duties of a single individual or department, just as bad organization sometimes confounds many conflicting interests in a single person.

The degree to which the separation of static and dynamic elements is effected by organization decides the value of its process. Taylor accomplished this by the development of the planning department, wherein he centralized the static element, by the functionalization of the foremanship, and by the stringent control over both through schedule and bulletin board. He expresses it in his fourth principle: to effect an almost equal division of the work and the responsibility between the management and the workmen; the management to take over all work for which they are better fitted than the workmen, while in the past almost all of the work and the greater part of the responsibility were thrown upon the men.

This does not mean that wherever a planning department flourishes the economic separation of static and dynamic has been accomplished, but the determination of the degree of their separation is a criterion whether or not the planning department fulfills its fundamental requirement. Many times it merely aims at such a separation and in reality duplicates static expense existing elsewhere. The economic justification of this centralization of the static element in the planning department is the greater efficiency of the static and dynamic effort when divorced from one another, and consequently the decrease of the *total effort* to render a given service. When the total effort is not decreased, the separation is incomplete or wrong, and the only way of reaching a clear determination of the situation is to analyze and measure it on the basis of its fundamental elements.

But audit of process involves a determination not only of the degree of the separation accomplished by organization; but also of the parts segregated and their measurement. This is accomplished with the aid of the process path, which is a record of every transaction and operation involved in the business cycle, whether static or dynamic. Although some organizations accomplish the segregation of static and dynamic efforts for operations as a whole in accordance with the principle of balancing organization and purpose, a complete violation of this principle may be found with respect to the internal organization of one or more of the units of the whole. This happens where development is not based on fundamental principles, but is copied from what somebody else may be doing, or, worse, is a mixture from several patterns.

For example: in a planning department where control data and final records are conceived as the dynamic volume and the supervision and guidance of

these as the static expense, the writer has found that of the yearly total of \$45,000, the static expense was \$35,000 and the dynamic volume could be estimated at only \$10,000. Here static and dynamic were mixed up and the principle of their segregation, well accomplished as between the shop and the planning department, was forgotten as to the planning department itself. The process path both in length and frequency had indicated this incongruity, but a segregation of the static and dynamic on the basis of the organization produced the conclusive evidence and pointed the way for a remedy.

B. *Uniform Load.* The first requisite for a high dynamic is a uniform load, because there is then no need for investment in extra capacity for peak loads. In case peak loads are unavoidable, as established by our primary balance of the business problem and organization, the static has to be assumed accordingly. Concrete values are found by comparing the units-sold curve (dynamic) for a twelve-month period with the units-manufactured curve for the same period. The unavoidable high point in the production curve is the dynamic volume; the total machine or plant capacity is the static volume. In balancing dynamic volume with static volume, process would be most economical if they were equal to one another, i.e., if the plant were running to capacity; however, extra static volume allows better upkeep of equipment and provides for flexibility and expansion. Excess static volume is also a safeguard for uniform load, as production need not be curtailed through breakdowns or changes. A moderate excess of static volume is fundamentally justified in any process, but its extent must be determined for the individual case.

C. *Path of Process.* The balance of static and dynamic elements on the basis of the process path is most obvious and interesting where it involves transportation of raw materials, group assemblies and final assemblies of the worked materials; but the principle applies equally to office, laboratory, planning department and engineering department. And although we are interested just now in the ratio of static expense to dynamic volume, a third element enters as a deciding factor in connection with transportation—the *static investment*. As a rule static investment not only decreases static expense, as with conveyor installations, but it also increases the dynamic volume of work accomplished, and we therefore have to do with a factor of potential value insofar as process is concerned.

Considering the process path as an entity, the static investment is the capital tied up in all provisions for traffic in orders, specifications, reports, tools, stores, worked materials and samples, and includes floor-space for aisles, roads, runways, bridges, conveyors, tubes, chutes, elevators, hoists and trucks. The static expense in this connection is the cost of operating the entire traffic.

It goes without saying that the greatest economy would be achieved if no money were expended for the static element of work; that is, if work would flow automatically and self-propelled through definitely established mechanical channels. The advantage of such a process is recognized generally; it passes under the name of continuous production. It involves intensive static investment justified by volume, uniform load and assurance of a long period of use. Investigating process in this respect will mean weighing against one another the values for static investment, static expense, dynamic volume and uniform load, the results depending of course on the general conditions of the individual case.

These values also serve as a basis for a valuation of the technical means employed. This valuation is of necessity a matter of personal observation, experience and judgment to which no rules apply; however, the principles for such a valuation as described in the foregoing will form a working basis for attempting an appraisal of this respect.

D. *Construction.* While we have said that a criticism of the static investment from a technical standpoint is a matter of personal experience and that no definite rules exist for it, and while we want to let this stand as a generalization, there are nevertheless certain fundamentals to be weighed in a balance of the static and dynamic elements in technical construction.

Construction enters into a discussion of process very materially in this day of mechanical development. It constitutes the final factor in a process—involving plant, equipment, tools, and mechanical facilities—which in some instances are the backbone of an entire industry and sometimes the main element in its process.

Statics and dynamics have always been considered antipodes in a physical process in a more or less theoretical way, but their application here to a machine unit as a part of a manufacturing process is essentially practical. As a machine unit accomplishes often only one of many operations and frequently constitutes only one element in a cycle of elements,