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In a sense, one might say that certain elements of public systems management or program budgeting are as old as civilization. To a greater or lesser degree, every rational person makes some plans for allocation of his limited resources, has certain goals or objectives, and considers alternative means of achieving these. The concepts and methods of public systems management or program budgeting as it is understood and practiced today are, however, of relatively recent origin.

There are two roots of these concepts and methods: One in the federal government itself where program budgeting was introduced as part of the wartime control system by the War Production Board in 1942; the other root--an even longer and older one--is in industry.

Program Budgeting in the Federal Government

Let us start with the part that identifies with the federal government because this is the one in which the author was closely involved and with which he therefore has a greater familiarity.

In the early summer of 1940, President Roosevelt created the National Defense Advisory Commission which was to assist our friends or "allies-to-be" in facilitating their war efforts. To do this, a variety of new or expanded production efforts and a number of new construction projects were undertaken. In all of this, the building of ships and shipyards and the construction of new factories, one item of demand was common--overhead cranes.

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As a result, by late 1940 the first of what was to become our World War II controls was introduced--a limitation order controlling the schedule of distribution and use of overhead cranes. This was followed over the next year and a half by a series of orders that copied the pattern of control of industrial production and distribution that had been used in World War I.

There was a limitation order dealing with aluminum as the aircraft demands made this metal in short supply. There were orders dealing with various alloying materials, as hard steel demands for military equipment increased. There were orders stopping the production of pleasure automobiles to cut back the use of materials like chromium and components such as ball bearings, and so on. The result was that even before the war had started, by the summer of 1941, a real traffic jam had developed in our control system.

The military were using authority that had been given them to place priorities for deliveries of finished products such as tanks, aircraft, ships, and the like. The civilian supply agency also was authorized to place priorities on steel, copper, aluminum, and other materials for milk pails, medical and hospital supplies, and other essentials.

A great many priorities were issued and they soon started to outstrip available supply. As a consequence, it became apparent that this way of doing business--separate controls for each situation--was not likely to work. In the early fall of 1941, a scheme which was developed by the author--the Production Requirements Plan--attempted to deal with the priority and allocation problem on an across-the-board basis. Shortly after Pearl Harbor, this was made a mandatory nation-wide system.

However, the Production Requirements Plan had been designed as a stopgap measure. That is, recognizing that the military did not know what was required to build their ships and planes and tanks, and that they did not have a schedule that could identify delivery in appropriate time periods, and did not have a way of effectively controlling the dollar volume of contracts placed, there was one essential need--to identify these fundamentals.

The Production Requirements Plan was designed to identify the material and component requirements for contracts that were being placed by the military, and probably more importantly, to measure the inventories and capacities of America's producing industry. It was an interim step on the road to public systems management or a program budget in that it provided the first overall picture of the United States' need and resources for war.

From this we learned that we could not look at one thing at a time--be it airplanes, ships, or stainless steel milk pails on the demand side; or steel, aluminum, overhead cranes, and ball bearings on the supply side. As a consequence, by early 1942, the War Production Board was looking at the total of military requirements and the total of war-essential civilian requirements in terms of a series of identifiable groupings, and, perhaps more significantly, these groups were being studied by use of the analytical tools then available.

The essential features of the situation can be made rather simple. Although we needed all the airplanes that we could get, all of the airplanes were not that important. At some point, roller bearings for the 2000th B-17 were less important than the roller bearings for a refrigerator in a municipal hospital. At some point, the 1000th tank of a certain type was less important than the stainless steel milk pails which were essential for milk to be supplied to either soldiers or civilians. As a consequence, the War Production Board learned the need for weighing and evaluating, and this led to the introduction in late 1942 of the Controlled Materials Plan.

The Controlled Materials Plan is actually the first program budget used in the federal government. It usually is not so identified, because the budgeting was done in terms of copper, steel, aluminum, and other critical material rather than dollars, and for most people budget is associated with dollars. However, in choosing the media of exchange--copper, steel, and other critical items--it was recognized that, in 1942, dollars were less meaningful than physical resources. Currency could be created by fiat and without restraint, whereas materials of the type labelled as controlling were limited in quantity and their supply could be increased only by slow, and usually resource-demanding, expansion.

As a consequence, for the balance of World War II--that is, from 1943 through 1945--the system of production in the United States and the distribution of output from that system was effectively controlled through the Controlled Materials Plan, which was the first federal program budget. It is called a program budget--and I regard public systems management and program budgeting as one and the same--because it had the following characteristics:

- I. Major goals were identified in terms of
 - o United States or allied combat needs
 - o Essential civilian requirements
 - o Other essential military or civilian demands
 - o Aid to friendly nations
 - o Economic warfare
- II. Each major goal was identified in program objectives; for example:
 - A. United States Military
 1. Combat theater equipment and supplies
 2. Combat support
 3. Zone of interior activities
- III. Program objectives were further defined in program elements, for:
 1. Combat theater equipment and supplies
 - a. Aircraft
 - (1) (Further defined by type and model.)
 - b. Tanks
 - (1) (Broken down into size and purpose categories.)
 - c. Automobiles
 - (1) (Identified as trucks, jeeps, personnel vehicles, etc., and trucks further refined into size and use categories.)
- IV. Programs crossed service lines so as to identify land, sea, and air forces as well as essential non-military contributions to identified objectives.
- V. There was an extended time horizon. A budget was prepared every three months (or quarter), and it was projected for 16 periods (four years), that is, the next quarter and the 15 succeeding ones.
- VI. Alternatives were examined and systematic analysis was made of both supply and requirements. Sometimes this meant resources were augmented by stopping production; the outstanding example: gold mining. This provided additional labor and equipment for

other mining activities. In other cases, essential needs were met by "freezing" inventories and controlling distribution as was done in the case of passenger automobiles. In every case, the action was the result of analysis.

The systematic analysis was not necessarily systems analysis in the breadth and depth now identified to such studies; but under the Controlled Materials Plan cost-effectiveness analysis was performed even if it did not have the sophistication which is expected today. However, in terms of the state of the art of the time, the analytical and related methodology used in our World War II Controlled Materials Plan can be properly identified as a program budget.

The next steps in the federal development of a program budget took place in the Bureau of Reclamation, the Coast Guard, and some few other government agencies, and at The RAND Corporation.

Early in its history, RAND decided that the traditional standards for choosing among preferred means of warfare of the future--for example, for aircraft, higher, faster, more payload--were not the only ones and so expanded the criteria into what is now known as weapons systems analysis. The first of these studies was completed in 1949 and in it a number of new factors were introduced--e.g., social political, and economic--so that the study aims went beyond what the specific piece of equipment would do, and added considerations such as demands on the U.S. economy, and impact on the economy of the enemy. With the wide range of considerations in systems analysis, it was determined that there was only one way to bring this heterogeneous group together, and that was with the common denominator of the dollar.

At that time, RAND looked to the Air Staff for its data, and the dollar data were made available in the traditional form; that is, budget and financial information in terms of equipment, construction, personnel, and the like. Although there had already been some efforts in the Air Staff to develop a means for looking at weapon systems, these had not proceeded very far, and as a consequence the traditional budget and financial data were something less than satisfactory for weapons systems analysis as developed at RAND.

If one wanted to do a systems analysis in which there would be a comparison between various types of bombers--for example, the proposed

B-47 and B-52 and the existing B-29, B-36, and B-50-- the data just were not available. When RAND decided that it would have to engage in a more detailed analysis of the economic requirements of the proposed weapons systems, it became necessary to examine in considerable detail the available sources of information.

After several years, it became apparent that these would not provide the answers if they were maintained in the existing and traditional form. As a consequence, in 1953 there was a RAND publication¹ proposing the first program budget to be applied to the Air Force. It also suggested that the methodology could be extended to the total of military activities.

The Air Force accepted this document with something less than complete enthusiasm, and as a consequence the idea "kicked around" for many years. As an aside, although the Air Force did not endorse the idea, it also did not prohibit, or in any way interfere with, RAND continuing to consider the concept. The consequence was continued study and publication at RAND of ideas which are now associated with the program budget. This led to a culmination in 1960 in two documents-- one, The Economics of Defense in the Nuclear Age;² the other, New Tools for Planners and Programmers³--which were brought to the attention of persons in the incoming Kennedy Administration who generally agreed that this might be one way of facilitating the treatment, analysis, and study of one large segment of the United States budget, namely, the military components.

In 1961, the initial effort was launched in the Defense Department and it has continued since that time. Program budgeting in the Department of Defense has been the subject of various types of criticism-- most of it complimentary.

Program Budgeting in Industry

In 1959, after the author had been writing about the PPBS for more than five years, he had a visitor who said he had only recently become familiar with the Novick proposals. He said that on reading the material he thought I would be interested in his experience along the same lines. He had with him a set of documents--General Motor's Budget and Finance Procedures for the Year 1924.

The visitor was Donaldson Brown, who had retired as Chief Financial Officer of General Motors and who was until his death a member of the Board of Directors of DuPont. According to Mr. Brown, by the time DuPont made its investment in General Motors, DuPont was already using something very much like a program budget system. And, this type of planning and budgeting was one of the major innovations in General Motors after the takeover.

The 1924 documents included a basic feature of the PPBS method which is to set forth identified major objectives, to define programs essential to these goals, to identify resources to the specific types of objectives and to systematically analyze the alternatives available. This may be simplified by illustrating it in automobile industry terms. For example, at General Motors it means not only dividing up between Chevrolet and Cadillac divisions and the other major lines that General Motors produces. It also means, within the Chevrolet line, identification of objectives in terms of price classes, categories of cars that are to be offered, and setting up specific programs for each of them, then calculating the resources required and the potential profits and losses under various conditions. Businesses that are now introducing or are thinking of introducing the Planning-Programming-Budgeting System are also faced with the problem of thinking through once again their objectives and goals, the alternative programs available for accomplishing them and choosing between them. For the company this means analyzing all of the interdependent activities in achieving a specific goal--looking at the whole, not just a series of parts.

Now the word "potential" immediately introduces one of the major factors in the program budgeting system. That is, that we are dealing with uncertainty. In the typical budget proposal, a relatively short period of time is usually considered--that is, one year--and in handling that, it is assumed that there is complete confidence and knowledge about what will transpire.

The truth of the matter is that even within as short a span of time as a year, things happen and events do not work out exactly as planned. As a consequence, even then there is an element of uncertainty

One of the major features of the system that was introduced in General Motors was the fact that they were planning for next year's automobile and the ones to be marketed in the 2d, 3d, 4th and 5th years. That meant they had to deal with uncertainty in terms of 4, 5, or more years in the future.

In the current time period, next year's model or the automobile for year I is a fixed thing with only a little possibility of change. The article for the year after that, or year II, is almost a fixed thing because commitments must be made to long lead-time items as much as 18 months in advance. Even the automobile for year III is fairly well developed at this point in time and they are also planning for automobiles for years IV and V.

In other words, General Motors continuously has five model years in planning, as well as one model in production. And, they look at all of these in terms of all of the possible alternatives they can develop with respect to market conditions, kinds of competition they will be facing, changes in income for their customers that can be projected, and the like. And this leads to a broad range of studies or systematic analyses. In addition and on top of this, they are at the same time treating of the capital investment program, because by and large they cannot make capital investments for an automobile more close at hand than year VI. In fact, if a change requiring investment in new plant is to be made for an earlier period of time, they must take into account the extraordinary additional costs that will be involved.

Concluding Remarks

Although there is a long history of program budgeting, even though it originates outside of the federal establishment, even though there are some 25 years or more of history that we can identify to the activity within the federal establishment, the truth of the matter is that the problem that is now being faced--that is, the application of the PPB or public systems management concept to new areas of interest--is a new and very difficult one. And, one of the major problems is that of identifying the missions, the objectives, or the goals of public management. For example, for the U.S. Government this is not only for

the federal establishment as such, but also for each of the offices and agencies which make up the total of the executive department. This same situation occurs at state and local government levels.

Businesses that are now introducing or thinking of introducing the Program-Budget system are also faced with the problem of thinking through once again their objectives and goals, developing programs for achieving them and choosing between the alternative programs that are available. Identifying end objectives, designing of alternative ways of achieving the objective, and choosing between them on the basis of systematic analysis are the hallmarks of Program Budgeting and Public Systems Management.

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