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PARTICIPATIVE DEVELOPMENT OF A
BUDGET SYSTEM FOR OPERATIONAL CONTROL

by

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Eindhoven, 1984
ABSTRACT

A control taxonomy is proposed, based on the three control levels (strategic planning, management control, and operational control), and two kinds of feedback mechanisms or control types (decision-oriented and period-oriented). Budgeting belongs to the latter type; traditionally, its use as a control instrument tends to be restricted to the management control level. This paper argues that budgeting should aim also at the operational control level, and it describes a case-study where such a budget system was developed.

Central in the development process is the concept of a goal structure. The participative development of a budget and information system for operational control within a production department is described as a case-study. The development process is seen as a learning process.

1.0 INTRODUCTION

1.1 Control levels and control types

Almost any textbook on control systems and on management information systems starts by categorising planning, decision making and control in three levels (e.g. Anthony, 1965; Blumenthal, 1969; Davis, 1974; Burch & Strater, 1974):

(I) Strategic planning, usually associated with top management decisions

(II) Management control or tactical decision making, associated with management at intermediate levels
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(III) Operational control or technical decision making, associated with lower level management.

Below these levels operations take place. In literature it is suggested that each level has its own distinctive features and, therefore, its own information needs. Unfortunately this opinion leads to nearly-independent information and control systems. For example, for the production subsystems of a factory we find separately

- a financial oriented budget control system
- a production planning, scheduling and progress control system, (in short a production control system)
- a quality control system.

The budget control system is usually regarded as a part of the management control system used for resource allocation and cost control. Periodical report-preparation is a task for management accounting.

Production control as well as quality control systems may be classified as operational control in the Anthony sense. These systems "belong" to the production department, they are used by the department manager for keeping production within schedule and quality up to standards. The budget system is often an exclusive domain for the accounting department; there even may be a central budget staff group at the concern level. For the department manager the budget system is too far-off as to be useful for controlling his department. The connection between budgets and operational control is not made.

Any control activity is cybernetic by nature. Feedback from past decisions and past actions influences future decisions and future actions. This feedback-mechanism may operate at the level of individual decisions and actions: the intermittent, or even continuous monitoring of effects and consequences may lead to adjustments, whenever necessary. This kind of feedback is inherent in the execution of most operations; for example it is the customary way to control projects (P.E.R.T). In a production department, scheduling and progress control, as well as most quality control methods, do belong to this control type (A).
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Another control type (B) uses feedback periodically to compare the aggregated results reached during a certain period in the past, and the intended results as expressed before that period began. Whenever results are regarded as unsatisfactory, corrective decisions and actions may be used to influence results for future periods. Budget control is the most common example of this control type.

Combining the three control levels as defined by Anthony, and the two control types just mentioned, gives the matrix depicted in figure 1.

<table>
<thead>
<tr>
<th>CONTROL TYPE</th>
<th>CONTROL LEVEL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(I) Strategic</td>
<td>(II) Tactical</td>
<td>(III) Operational</td>
</tr>
<tr>
<td>(A) ACTION TRIGGERED CONTROL</td>
<td>(1)</td>
<td>(3)</td>
<td>(5)</td>
</tr>
<tr>
<td>- Focus:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>. individual decisions</td>
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<td></td>
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<td>. individual actions</td>
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<td></td>
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<tr>
<td>- Occurrence:</td>
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<tr>
<td>. ad hoc</td>
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<td>. intermittent</td>
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<tr>
<td>. continuous</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(B) PERIOD TRIGGERED CONTROL</td>
<td>(2)</td>
<td>(4)</td>
<td>(6)</td>
</tr>
<tr>
<td>- Focus:</td>
<td></td>
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<td>. aggregated results</td>
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<td>. periodic</td>
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</table>

Figure 1 A control taxonomy

The six boxes in this matrix may be used as the basis for a control-taxonomy. As it is this paper's intention to highlight the operational control level, we will not elaborate on this taxonomy. However, some remarks may be useful here:

- At the strategic level, box (2) in most cases is "empty", because strategic planning is not a repetitive process; control can only be directed at individual decisions (or plans)
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- At the tactical level, the accent uses to be on box (4). It is at this level, resource allocation to the various departments takes place; mostly this is a periodic and a repetitive process. This is the most common use of budgets as control instruments.

- In most cases at the operational control level, the accent is on box (5). Because little attention is paid to a periodic evaluation of the aggregated results from day-to-day decisions and actions, systematic errors in performance may not be detected. In this box the potential value of budgets as control instruments is under-estimated.

Earlier research by Maassen and Theeuwes (1979), covering about three hundred medium and larger production firms in the Netherlands (over 200 employees), showed that budget systems were relatively seldom effective as control instruments. In about two thirds of these firms there existed some form of budget system, but often these systems were mental property of an accounting department, while procedures and reports were unclear to budgettees. Perhaps it is for this reason that in many cases budgeting is regarded as a sort of religious ceremony— a rain dance (Cleverly, 1973, as cited by Gambling, 1977).

1.2 Budgets as control instruments

Let us assume that a good budget system has the potential for being an instrument for enlarging the effectivity and efficiency in a production firm. We could ask then, which requirements make such a "good" system, and how it is to be effectuated. "Good" refers to the "instrumentality" of budgets for control purposes, i.e. for reaching results as intended.

Especially the behavioral aspects of participation in budget preparation are covered in many books and articles. Standard works are e.g. Argyris (1952) and Hofstede (1967). Often the initial statement is "Participation is good for motivation and, therefore, for effectivity and efficiency". Real proof that this statement holds for participation in budgeting is scarce. Some research into this relation was summarized by Lilleyman (1979). His conclusion was: "In practice there is only a limited positive relationship between the degree of participation [in budget preparation] and job performance." Although partici-
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Participation in budget preparation may lead to commitment, and thus may contribute to the instrumentality of budgets, other aspects may be more important.

In order to be instrumental, information derived from a budget should both be relevant, and be expressed in sufficient detail. Those aspects can best be judged by the (future) users of such a system. Therefore we hypothesized that participation in budget preparation is necessary, but not sufficient to create an effective instrument for the control of a production department. A participative approach should be used for the development of the budget system too. Furthermore, in a budget system, management control and operational control should be integrated. Cost control, together with production control and quality control, should be regarded as interconnected subsystems for operational control; the cost control subsystem makes up the linking pin with the management control system.

The participative approach to the development of a system for operational control is this paper's main topic. However, we cannot separate our description of the development process of a control system, and the contents of such a system completely. A large department, using complex production techniques, certainly is a complex system in itself. This complexity is enlarged when the system environment is less stable. Under these circumstances sophisticated planning and control techniques are needed. When expertise in these techniques is lacking within the department, help from outside specialists may be inevitable. Any operational control system should be based on a model of the object system, i.e. the department in question. The model should reflect the structure of the decision making processes with regard to the department; this requires a control system made ready-to-measure. Because the production managers together with their subordinates are the only people possessing detailed knowledge on the object system, these people should participate actively in the system development. At the same time, these people will be the users of the future control system. Participation in the development will help to bring about the thorough understanding which is necessary for the system's effective use.
1.3 Topics to be discussed

In the present paper we will describe our ideas on participative development methods for such systems. An introduction to a practical situation, used as a pilot study, is given in the next section. In section 3 we describe the design methods used for developing and implementing a budget control system in that situation.

Quite central in these methods stands the control structure of the organizational unit involved. To illustrate this we will use the quality control structure as an example. This paper's final section is a discussion on some results.

A point, not discussed in this paper, is the importance of leadership. Leadership permeates all activities. Some activities are associated with the staffing of the project; another class of activities, maybe even more important for success or failure of the project, is motivating all people involved to cooperate actively in the project and for maintaining a certain degree of alertness in the organization (cf. Mintzberg 1973, pp. 61-62). In our case study this proved to be an important success-factor.

In a companion paper we will elaborate on the integration of management control and operational control systems.

2.0 A PILOT STUDY

2.1 The context

In order to test our hypothesis and ideas by "Inquiry from the Inside" (Evered & Louis, 1981), we were looking for a real organizational setting. This research method included acting as participating specialists, introducing ideas on control systems in an ongoing production department, and helping in systems development. On the other hand, it included observing the development process. We were happy to find a suitable situation for this purpose, viz. the diffusion department of a semi-conductor plant manufacturing integrated circuits (IC's).

Shortly before starting this project, a production control and informa-
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tion system was constructed by a similar participative method (Bertrand & Wortmann, 1981). For us, this was an opportunity to build on previous knowledge and to come to an integrative approach to operational control. From the standpoint of the department management, our new project could be seen as an addition to the former project.

For the plant (and the firm) to which the department belongs there exists a budget system, carried out by a Budgeting and Accounting Department (BAD). This system could be termed as "traditional", the value of budget information being very limited for control purposes within the department. Management hoped that the envisaged system would be more useful for this purpose, while--on the other hand--there was a need for better tools to explain the budget variations as reported by the BAD.

The department is one of the production departments of a semi-conductor plant of a large international firm. Within this department thin silicon slices, each with a great number of identical integrated circuits (IC's) are manufactured. Each individual IC on a slice is tested before the slices are delivered to another plant, where the slices are broken into "crystals" to be mounted in a plastic housing. Manufacturing is in batches of--at maximum--a hundred slices. The process takes seven or eight nearly identical process phases. Basically each phase consists of ten to twenty-five individual operations which can be summarized in the following sequence:

1. A "furnace" operation
2. A set of "photographical" operations
3. A set of "etching" and "cleaning" operations
4. Another "furnace" operation.

The whole process takes well over a hundred operations. There are no completely identical phases in a given manufacturing process. There is a limited number of "process-types", each type being defined by another sequence with somewhat different operations. Within each process type, a nearly unlimited number of different IC's may be manufactured by using different masks within an--otherwise identical--photographical operation.
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Inputs used are raw materials (silicium slices, masks, photographic lacquer, metals, gases, chemicals, energy). Furthermore manhours (operators and staff) and, finally, equipment hours. It is a typical job-shop situation in which most of the equipment can perform a category of similar operations.

Absenteism and turn-over on the part of operators, and malfunctioning on the part of equipment, are causes for irregularities in the production flow. These irregularities give rise to waiting times at certain stations, while other stations may remain idle. Trouble-shooting is only a partial solution to these irregularities. The policy of the department management is to create a surplus of equipment capacity as compared with operator capacity. However, equipment break-down and maintenance may—temporally—create unexpected bottlenecks in the production flow.

2.2 Production control

The customer function in our case was incorporated in a Material Management department. Capacities being given, at least in the short run, monthly agreements as to output are made. In order to arrive at those agreements, standard tasks times needed and available capacities—up to their capacity loading limits—are reconciled. At the same time a prediction is being made for capacity needed in the longer term. For operator-capacity this longer term comprises at least three months. This prediction is used in order to adjust the operator-capacity to the predicted demand.

Adjustment of equipment-capacity usually takes well over one year. Coordination of predicted demands and investments/devestments takes the form of a four-year "business plan", made each year as a revolving plan. The first one of these four years constitutes the basis for the yearly "financial department budget" and for the calculation of standard cost prices by the accounting department.

There are relatively accurate standards for raw material use. For all operations, standard times are set with respect to both operator tasks and equipment use. These standard times play an important role in production scheduling. Batch flow time, of course, consists of pure operation times and waiting times. Waiting times occur if a number of
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batches compete for capacity at the same moment, resulting in a queue. For most queueing stations, a major part of the waiting time is due to operator capacity constraints. Queueing threatens short and reliable batch flow-times which are among the preponderate goal variables of the diffusion department. Thus, in order to keep average queueing times within reasonable limits, there has to be a certain excess capacity both for equipment and for operators. This excess capacity is maintained by employing a "capacity loading limit" (C.L.L.) in setting production levels, i.e. a maximum fraction of available capacity allowed for loading a category of equipment, or loading a category of operators (Bertrand and Wortmann, 1981; p. 129). Beyond this limit waiting times for "overloaded" stations tend to increase sharply and, thereby, actual batch flow-times may become nearly uncontrolable.

An important decision for influencing batch flow times and for maximizing outputs is batch release. Capacities being given, the workload should be kept relatively constant over time. For this purpose the output per capacity group during a one-week-period should be measured; this output is computed as the operations performed, multiplied by the standard task time involved. When new batches are to be released, total task times per capacity group incorporated in these batches should—in principle—be equal to the sums of the standard tasks times performed during the previous week. This is the underlying principle of the production control information and scheduling system described by Bertrand and Wortmann (1981), which was implemented before we started our budget information project.

The released batches, in turn, should get a due-date in accordance to agreements made with customers. For every operation on each batch a due-date is determined. The total flow time for a batch, from start to finish, is about twenty to thirty working days, according to the process type involved. During this period, non-controllable and only partly-controllable factors may influence production progress. However, the due-dates issued at the moment of batch release are regarded as fixed.
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As stated above, operator capacity usually acts as a bottle-neck in the short term. If no action is taken, variations in work supply to one or more work centers may result in operator idle time. Fortunately many operators are able to perform several different tasks. Up to a certain degree this property may be used to prevent operator idle time from occurring. In the very short run, one of the most important decisions for maximizing outputs and, thereby, for efficiency control, is the allocation of available operators to the stations. By the same decision batch waiting times may be equalized and batch flow times shortened. However, because not all operators do have multi-task capabilities, and because operator reallocation can only take place at the start of each shift, the allocating decision is far from easy!

At the work-floor operators, finally, select batches from the queues waiting at the work centers. Priority is given to batches with the smallest due-date-numbers for the imminent operation. In this way, batches that lay behind their planned progress are speeded up, whereas batches that are ahead of schedule are retarded.

In this subsection we have met a number of different timespans pertaining to agreements and decisions made. Any operator has to select several batches each day. The time span for handling of unforeseen disturbances by means of operator allocation may be very short although for practical reasons reallocation only takes place at the beginning of each shift. At the other end of the scale, investment decisions are based on expected demands over a period of up to four years.

2.3 Quality control

From the description of the manufacturing process it will be clear that a great number of factors may influence product quality. Unfortunately, given the present state of technology, for many of those factors the actual correlation with product quality is not known. Product quality for a given batch is an aggregated result from over one hundred operations, spread over a five-week period, corresponding to the batch flow time for this batch.
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In our view a quality control system should encompass both the tactical and the operational control level. This is to say that all four boxes (3) to (6) (cf. figure 1) are relevant in a quality control system. In order to develop such a control system the quality control structure has to be mapped out. In this paper's next section a map of this kind will be used as an illustration.

3.0 THE LEARNING APPROACH

3.1 Approaches for M.I.S.-development

We did not find much detailed literature on specific steps and tools required in participative development and implementation of control systems in general, nor on the development and implementation process for budget systems. However, a budget system may be regarded as an information (sub-)system, designed for generating feedback information. In the field of information systems there is an abundance of methods for systems development and implementation.

![Diagram of development process]

Figure 2 Straight forward approach

Roughly speaking, the approach for systems development, as advocated up to 1970, can be illustrated by figure 2. The approach is straightforward, in the sense that it does not recognize the fact that feedback from later design stages may induce some redesign. Blumenthal (1969) contributed to this idea by requiring that each development project for an information system should be part of a company-wide framework. Such a framework became to be known as the information subsystems master plan. One goal was to enhance the consistency of future information systems, and to mitigate the need for redesign.
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After 1970 a growing awareness of design as an iterative process emerged. It was stressed that experiences in the detailed design could induce changes in the gross design; similarly, findings during the implementation stage could induce changes in the detailed design, and so on. This resulted in the idea that the design process could be cancelled at any point, and that any feedback-loop was possible. Such an iterative approach is depicted in figure 3 (source Davis, 1975).

![Figure 3 Iterative approach](source Davis, 1974, p. 416, adapted)

The growing consensus on the iterative nature of the design process stems from the fact that in real life such projects often proceed in an iterative way, and even that many information systems "emerge" in an evolutionary way.

Merely including feedback-loops in the design approach creates two problems, a practical one and a theoretical one. The practical problem has to do with project planning and control for the development process. If endless iterations are allowed, how do we plan such a project, and how do we measure its progress?

The theoretical problem pertains to the causes of the iterations. For what reasons should feedback-loops be included in the design process? Why do information systems have to change so often?

3.2 Implementation induces learning; learning induces change

In most design situations two groups of people are involved. Firstly, there are the experts, people with a theoretical background in production control, in budget systems, or in information systems. They are experienced in design. Secondly, there is the so called client system, the whole group of stakeholders in the future budget or information
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system. In general, this will not be a homogeneous group. It members will have conflicting interests, different values, different jargon, different conceptualizations of the organizational control structure. In the formal organization structure they will be operating at different levels of authority. In order to design a new system for budget control, together with its information subsystems, a design team may be installed. In this team representatives from the client system, and one or more experts will cooperate in some form of a project organization.

Let us assume, for a moment, that a design team is able to develop a common language, and that it succeeds in transferring this language to all relevant groups. Suppose, furthermore, that initial agreement can be reached on the initial conceptualizations of the organizational control structure. Suppose, finally, that initial agreement can be reached too on the rules of the game of budget control (Hofstede, 1967). Even when all of these conditions are fulfilled, there is no way to assess exactly how the ideas on a budget system will change, as an aftermath of the implementation of a proposed budget system. This message can be drawn from behavioral-science literature. For example, Chin & Benne (1969), summarizing strategies for organizational change, emphasize that in the "normative re-educative strategy" research, training and action cannot be separated. These authors consider organizational change as a learning process, both for the experts, and for the client system.

Likewise, the implementation of a budget system is, for an important part at least, a learning process. A budget system should aim at clarifying organizational responsibilities; it should also aim at assessing the relation between controllable variables, environmental variables, and goal variables for each decision center in that part of the organization which is to be "covered" by this budget system. The learning process can, and should, lead to a re-definition of the budget system, including the budget procedures for the decision centers involved. Considering the introduction of a budget system as a learning process provides an answer to the theoretical problem stated above; it explains why change has to occur.
3.3 Controlled experimentation

The insights from the foregoing subsections compose the basis for our design approach. This approach is partly iterative, i.e. it supposes that for each separate decision center, where budget control is implemented, learning will occur. The approach is plotted in figure 4. The broad outline is as follows:

Following the project definition (phase I), the control structure of the organizational unit(s) involved takes a central place in the whole project. The term "control structure" refers to the collection of decisions, taken on a more or less regular base, together with the relationships between these decisions. In most cases, these decisions originate in several decision centers. Analyzing the control structure is phase II in our approach. This structure brings on a preferred sequence for the implementation of subsystems for budget control in support of those centers. This sequence is reflected in a budget control master plan.

Each of the decision centers in the control structure will outline its proposed decision procedures and budget procedures (phase III). The purpose is twofold. Firstly, it is strongly advocated that a decision center starts using the new procedures immediately, using manual information processing methods. This enables quick proceeding, and enhances learning in a major way. Secondly, the proposed procedures constitute a basis for defining the information requirements needed in phase IV. The latter phase yields the information systems master plan. This plan not only shows the information subsystems to support decision making and budget control, but also the data-sets required. Furthermore, it defines the information subsystems for transaction processing, which are necessary to yield information on past decisions and their outcomes.

In phase V a budget information subsystem can be developed for each decision center. The budget control master plan indicates the sequence in which those centers will be approached. After the implementation of the provisional budget systems, experiences with budget control will lead to modifications of the budget information subsystems in support of budget control.

Last, but not least, the functioning of all procedures and information
Figure 4 Learning approach (partly iterative)

subsystenns for budget control should be monitored, and periodic evaluation reports should be prepared.
3.4 The learning approach in more detail

After the broad description in the foregoing subsection we will give now a more practical and detailed description of the learning approach. We will illustrate this by an example, taken from the diffusion department described in section 2.

Firstly, as stated above, the control structure is analysed for the client system as a whole. To be more specific, the analysis starts top-down by charting the goal structure, i.e. by a detailed statement of the client system's ultimate goal variables, together with all intermediate variables, directly effecting the ultimate goal variables. These intermediate variables, in turn, can be related to other intermediate variables. Working backward, variables can be identified which are directly controllable by certain decision centers. Most of these centers do belong to the client system, in our case the diffusion department. Some centers, e.g. the Materials Management department which acts as the "customer", belong to the diffusion department's direct environment. The analysis of the goal structure, and the development of the control structure, is a task for representatives taken from the client system; they may be aided by experts in operations management theory.

To start the next part of the analysis, all relevant decision centers within the client system are identified. This will prove to be far from easy. The analysis now becomes bottom-up. Each center is responsible for one or more local goal variables, each local goal variable being either an ultimate goal variable, or an intermediate variable as identified in the goal structure. Starting with the controllable local variables, the control structure is derived by following the paths in the direction of the ultimate goal variables. Non-controllable, but influential variables are specified. The latter may be controllable by other decision centers outside the client system. It should be stressed here, that decision centers belonging to the client system cannot be held responsible for the influence of those non-controllable variables on ultimate goal variables.
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As an illustration, we choose the control structure for quality control in the diffusion department. We took this example in order to show that budgets are applicable to all areas of operations management, that they need not be stated in financial terms, nor even in quantities such as hours, number of rejects, etc. In our companion paper we will use a more quantitative example, taken from the same production situation.

The control structure for quality control is given in figure 5. Reading from right to left one finds the decomposition of goals; to find causal relationships this "map" should be read from left to right. It is somewhat simplified for ease of reading.

Figure 5  Decision and control structure
(Quality control)
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The control structure may be used as a basis for a budget master plan. The sequence, in which formal budget systems for individual decision centers will be developed is decided upon by the management of the client system (the diffusion department). For such a decision there may be divergent arguments. Firstly, the control structure depicts the logical interrelations between decision centers. Next, management has its own preferences for those areas, where improved control might contribute most to ultimate goal realization. Finally, budget control relies heavily on actual measurement of real events; in order to perform these measurements, the information subsystem for transaction processing should be compatible with the budget control procedures envisaged. Consequently, the budget master plan should be in line with the information systems master plan.

As soon as the control structure has been specified, individual decision centers may start with an informal budget system in the following way:

- Periodically a realistic target is set for the control of local goal variables for the decision center
- The targets should explicitly be based on assumed values for non-controllable variables
- During a period, the local goal variables, the controllable variables, and the non-controllable variables are measured or approximated
- At the end of the period, management discusses these figures with the employees involved—but only for learning purposes for both parties!

In this way, the parties involved in the decision structure may discover more refined relations within this structure, or they will find more quantified models for those relations. Experts on budget systems and on operations control theory may contribute to the experiments with informal budget control.

*) Bakker, Theeuwes & Wortmann (1984)
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It should be stressed once more, that information for budget control purposes preferably should be in non-financial terms. However, if there are good reasons to "translate" the information for budget control into financial terms, physical quantities may be multiplied by prices. This translation is hardly ever required for operational control purposes. Where translation is useful for management control, the procedure as suggested here guarantees that both management control, and operational control, are based on the actual control structure, and that the same information is used at both levels.

Learning is not restricted to the informal, provisionally situation. To some extent it also may be expected when budget systems are supported by formal and more definitive information subsystems. Much information will be derived from costly information subsystems for transaction processing. In addition to these subsystems, relatively cheap decision support systems may be devoted to budget control. Provided the semantics of the transaction processing subsystems are compatible with the concepts used in the control structure, changes in budget procedures for a single decision center only require inexpensive changes in the budget information subsystem for that decision center (cf. Bertrand & Wortmann, 1981, p. 103 ff.). When budget information systems are designed in a way to make flexible adaptation possible, experimentation with formal information (sub)systems could be allowed. During these experiments, budget systems experts may help to find more exact definitions for the variables which are relevant in the game of budget control.

4.0 SOME CONCLUSIONS

Operational control in manufacturing departments may be regarded as the foundation, on which an organization's performance is built. Planning and decision making at the operational control level aim at keeping operations up to schedule, and quality up to standard. In addition to this, operations should be effective, i.e. produce outputs as intended, and efficient, i.e. produce those outputs in the "best" way possible. At this control level two control types are relevant:
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(A) Feedback on individual decisions and actions, leading to "real-time" corrective action

(B) Periodic feedback on aggregated results from past decisions and actions, leading to corrective action in future periods.

The latter control type is typical for budget control. At the operational control level however, this control type is underdeveloped. In our opinion, budgets could be useful instruments for signaling systematic planning errors, and errors made during the implementation of plans.

Usually budgets are financial-oriented. They are regarded as accountants' instruments for allocating financial resources to departments, and for cost-control purposes. It has been argued that, within a manufacturing department, for control purposes the value of this financial type of budgets isn't but very limited.

Any operational control system should be based upon the organization's control structure. This statement holds true for budget systems for operational control. A control structure states which ultimate goal variables are regarded as relevant, and connects them with decisions made upon controllable variables. In addition to this, influential variables, which are non-controllable from the department's stance, are revealed. They may be controllable elsewhere.

Reflections upon a control structure may result in organizational changes. Firstly, these reflections may lead to changes in the structure of the department in question, or to shifts in the task-allotment between departments. Secondly, budget and information systems per se will affect the control structure. Those systems will become tools for a better understanding of factors, attributing to the extent in which ultimate goals are met. Thus, budget and information systems contribute to a better understanding of the control structure. Better understanding will lead to modifying this structure.

Developing budget and information systems should be a learning experience for the organization's members. This implies a participative approach in the developing process. In this process, experts should restrict themselves to a supporting role. It is their expertise on bud-
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tiating and information systems in general, that can be used as an input.
Learning implies too, that in a stable environment, it will always be possible to build systems at a higher level of understanding. In a turbulent environment, budget and information systems may lead to a faster adaptation of the organization to its environment.

In a controlled experiment in a real manufacturing department, the learning approach was tested in the participative development of a budget system for operational control. The method was proved to be successful, notably for clarifying control responsibilities and information needs.

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