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Management System with Automation Means for an Industrial Group

"Automation is brought to fullfruition only through a thorough exploitation of its three major elements: communication, computation and control"

Sir **Leon Bagrit**
The Age of Automation

The experience gained by the present Institute for Management and Informatics in the achievement of informatic systems has allowed its synthetization in a project of management system with automation means — entitled SICMA — 1 and the experimenting in a first form of the basic modules of the system in two pilot units, the Group of Garment Industry-Bucharest and the Craiova Electroputere Enterprise, respectively. The selection of the two economic units was made by setting out from the fact that from the informatic point of view, they represent limit cases due to the different character as regards the structure of articles and of the technologies, respectively.

As regards the stages of the elaboration in time of the system, we mention that both the conception and the project were established and carried out in the 1972—1973 period, and the first experiments date back to 1973 (the substantiation of the 1974 plan). A big number of applications are in a stage of implementation at the Craiova Electroputere Enterprise, among which are the calculus of the plan variants, the calculus of the charging of the production capacities, launching and the control of launching, the administration of stocks, the pursuance of contracts and of the utilization of capacities. At the same time, the system is being deepened especially as regards the programming of production and the structure of the data base.

MAIN CHARACTERISTICS OF THE SYSTEM

We consider that the main characteristics of the SICMA-1 project are the following:

— The informatic system for management achieves the connections (integration) among all the functions of the enterprise (production, commercial, financial-bookkeeping, staff and research-development) and the centralization of data into a data base, being projected independently on the organizational structure. In this way, the difficulties in connection with the reprojection of this structure are being avoided. As a matter of fact, one of the effects of the putting into operation of the informatic system is also the change in the existing structure.

— The system is achieved as a cybernetic circuit with selfadjustment loops (Fig. 1), modelling the main attributes of the planning and control-pursuance management, corresponding to the management levels in an economic unit-strategic, tactical and operative.

In the strategic and tactical zone, management is achieved especially through objectives and in the operative and adjustment loop zone, between the latter and pursuance-control, management is achieved especially through exceptions.

— By achieving a synthetic level of data aggregation, the implementation of the system can be carried out, in the first stage, in a relatively short time (about one and a half years); by avoiding the setting up of big files for elementary data, especially the equipment existing in the endowment can be used.

— The system (emerged from) the necessity of most efficiently using the electronic computers for the management of economic units, being intended for all levels of management in an economic unit.

— The implementation of the system mainly starts with the first two levels of management, because it is considered that it is here that decisions are being taken, which can influence, to the greatest extent, the proper evolution of the enterprise (these levels represent the maximum of efficiency zone).

The essential characteristic of the implementation of the system in the first stage, the data with which one operates are at a synthetic level of aggregates — makes possible the utilization of files with a relatively reduced volume (of the order of the thousands of recordings), easy to achieve in the estimated period (about 1.5 years).

Both strategy and tactics in the respective unit as well as a certain level of operative management of the economic unit are based on categories of data essential for the production process: on the one hand, a series of synthetic indices and on the other hand, data on the prevision and stage of the production process, of technical-material supply, of marketing, of the way in which the production capacity of the workshops, sections and factories and of labour can be used.

Data can be obtained in two ways:

The first, represented by the accumulation of all information and data from the production process is that of big files, with an implementation duration of about 3—5 years and which does not allow optimization calculus necessary for management because of the big size of matrices to be used;

therefore, after the setting up of these files, it is necessary to resort to global optimization models, by using synthetic data.

The second way, which was developed in the SICMA-1 project, is that of processing, in the first stage, the already aggregated data, subordinate to well established purposes, in a priority given by the importance and efficiency of the results to be obtained.

The objectives of the sort of those connected with the best planning of production, the establishment of the various influences on the implementation of the plan, the determination of the critical points of strangulation and of the available capacities, the optimal arrangement of the stages with a weight and importance in the activity of the plant, the correct orientation on the consumptions with a big weight in the critical materials, the purchasing of articles from collaborations, etc. do not require detailed information on each equipment or component of a plant. From the informational and decisional point of view, one cannot put in the same balance a screw nut and the coil of a transformer meant for a big group, a certain operation on a specialized equipment and the manual operation carried out by an unskilled worker.

In this respect, the experience of the plant is considered to be on a first plane, but, at the same time, a self-adjustment of the system has been envisaged, namely, by improving through the very functioning of the proposed sytsem, the aggregation level for various categories of data.

DESCRIPTION OF THE SICMA-1 PROJECT

The system which is conceived as a cybernetic system (Fig. 1) contains three main frustrums, grouped around a data base. The main frustrum is the strategic and tactical management frustrum comprising the modules for the substantiation of the plan variants or of the guiding plan, the spacing out of the variants on periods of time, the simulation of launching the supply orders, the ensurance of labour and of the units necessary for fulfilling the targets at the delivery terms. This frustrum refers to the period going from a month to a year and is built in the loop on the principle of a simulator; it aims at indicating apart from the level possible to attain in production also the effect of the decisions possible to take as regards the preparation of fabrication, the ensurance with materials and articles from collaborations, the loading of the production units, etc. Resulting from this frustrum are the plan proposals or the directory plan *) of the unit, the marketing and supply plans, the data on the preparation of fabrication, etc. The characteristics of the frustrum of strategic and tactical management are the synthetic elements, such as: the main indices possible to achieve and the measures to be taken for their attainment and also the spacing out of the tasks for each managerial body or compartament having the right to take decisions.

The second frustrum solves the problem of operative programming seen from the point of view of the management of workshops, sections and factories.

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*) Called in some enterprises directory program, guiding plan or basic program, etc.

The launching of production at the level of components*) is carried out, establishing the outfit to be supplied and manufactured for short periods of time (within a month), with the start and end data of each component, data resulting from the fabrication cycles correlated with the available units. The model does not pursue the optimal arrangement of the components on the work place; a deck of so-called "global scheduling" pursuing a "better" automatic arrangement of the components; in thus obtained cycles, the start and end data of the phases are established.

For each work point (workshop, section) the equilibrated charge on equipment and component lots, the physical and value production to achieve (global and commodity), the necessary components obtained from collaborations are established, with the terms at which they are necessary. Concurrantly, the working orders are launched and the technological files for each scheduled component, with the mention that they record the essential stages of the technological flow, thus practically, the state of the respective component, in each stage.

The third frustrum of the system achieves, in fact, its adjustment by closing the two adjustment loops.

The closing in the loop of the first frustrum is done in three ways:

The first closing (within the loop of the first frustrum) in the stage of the substantiation of the plan derives from the calculus of the real capacity of the unit related to the plan target, in which the decision maker correlates the objectives with the capacities and labour.

The second closing also within the action of preparing the plan (within the loop of the first frustrum), is achieved through the decision on the resulting variants and the third one, during the plan period by using the adjustment loop allows the equilibration of resources (capacities, labour, materials) and objectives in time, through the action on the terms of delivery of orders and of their priorities or the redistribution of resources.

Within the plan period (operative), the closing at the level of operative management is achieved both through the relaunching of the components which were produced partly qualitatively, rejected, etc. (by reprogramming the penalizations and by measures for efficiently improving, still in the course of the fabrication of a lot, the situations which might lead to the non-fulfilment of the guiding plan).

This closing just as the closing of the entire system through the main loop if it is necessary to intervene at the strategic and tactical level, is achieved also by recalculating at various periods the synthetic and analytic indices.

The human element occurs in all these loops as a decisional factor.

The simulator uses the OPALINE programme deck for the global optimization of the process of harmonizing the objectives with the resources for establishing the inferior and superior limits of the quantities to be delivered, represented by the level of the previous year and the necessities of the economy (exports included), in the conditions of the attainment of objectives of maximum of economic efficiency.

**) We mean by "components" units, subunits and parts which are physically retrieved in the fabrication process, in the technological documentation respectively.

The second programme deck — of our own conception — distributes the orders according to the principle of priorities and of the most homogeneous loading of capacities in time, pursuing by this the harmonization of the interests of the plant with those of the beneficiaries.

The results are processed through the ORACLE-BESOINS deck adapted and completed with our own modules. With its aid, the calculus of the time for the obtaining of components is obtained, a calculus which takes into consideration their technological period and the expectation time due to the fact that the real available capacities on periods are used. This way of work also allows the simulation of various situations by the operator, establishing the possible subjective priorities besides those imposed through the system.

Integration is achieved by using the single data base of the system, by observing the principles of singularity of information, the simultaneous updating for various files of the data base, interrogation possibilities, etc. These possibilities are obtained by using the SCF techniques (Système Chainage Fichiers), the data base being achieved through pairs of files of a principal and structural type for various functions (Fig. 2).

ADVANTAGES OF THE SICMA-1 PROJECT

Firstly, the relatively short period of time in which the implementation in the first stage of the system is achieved, due to the fact that one of its aims is at convincing the managerial body of the plants of the advantages of using computers in the management of production. The harmonization of the objectives with the resources both within the substantiation of the plan variants or of the fabrication, supply and marketing programmes, especially the adaptation of the guiding plan to the changes occuring during the plan period lead to considerable profits in each enterprise.

Secondly, the possibility of using the FELIX C-256 computers in the reduced configurations-without table discs-y with the available programme decks and the avoiding of the elaboration of original complex decks which require big social efforts.

In the third place, the typological character of the SICMA-1 project ensures the substitution of the lack of experience of the designing personel which, generally, is not older than one or two years in this field; it leads to a considerable saving of social labour, both in designing and programming.

The obtaining of efficient results in one or two years since the starting of the project, creates favourable conditions for the putting into operation and development of the system due to the fact that the enterprise managerial body understands to participate both in the utilization of the system and in establishing the zones in which it is going to be deepened. The way of "big files", requiring a long time for implementation does not create favourable conditions for sufficiently attracting the management into the implementation and development of the project.

In the fourth place, the deepening of the system takes place under control, namely in the zones in which it is efficient, by avoiding in general the setting up of big files and consequently, by obtaining important savings of equipment.

In the fifth place, the described information system allows a link from the level of the group to a macro-economic level, by achieving in consensus with the higher forums, the harmonization of demands with the objectives and resources for the families of products for which the integration of the groups and respective enterprises is sufficiently advanced.

CONCLUSIONS ON THE IMPLEMENTATION AND DEEPENING OF THE SYSTEM

The Craiova Electroputere Enterprise shows permanent interest in the implementation of the SICMA-1 project, actively participating in the elaboration of solutions and by directly leading the activity for their carrying out.

During the designing period, the conclusion was drawn, a conclusion which has been materialized in the project, that the aggregation of most data is practically achieved in the very technological documentations of the enterprise. In case that the data are not aggregated, it was envisaged that they should be aggregated through the computer or used in the form they were in the documentations of the enterprise (for example, the operation games).

Special problems were raised by the establishment of the fabrication duration of the components (inclusively, the determination of the expectation times) for which the collection of adequate data was impossible. For this reason, with the implementation of the applications aimed at establishing the tactical decisions, the applications of operative pursuance were also approached, especially in the fabrication zone, with the main aim at creating a history of the execution periods, of the lots of components on work points.

Due to the absence of technological structures for some groups of products (transformers), these structures have been achieved with the aid of the computer by using SCF.

As regards the data base, it was completed with aplan file and a personnel file; the file of technologies was turned into a file of technologies — operation games. This is mainly due to the fact that the development of the system is carried out at present with the orientation to the operative programming of production.

The impact produced by the system on the records of the enterprise should also be mentioned. From the qualitative point of view, the specific consumptions, the technology were updated and a unitary coding of all the elements of the system was achieved and concurrantly, the number and route of the pursuance and intermediate forms were considerably reduced.

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SYSTEME DE DIRECTION D'UNE CENTRALE INDUSTRIELLE A L'AIDE DE MOYENS D'AUTOMATION

La présente étude tente de faire un exposé, tant des principes régissant l'élaboration du projet, que des conclusions offertes par l'expérimentation à l'entreprise Electroputere de Craiova, des modules de base de ce système.

Quant à l'expérimentation qui a eu lieu à la Centrale industrielle des confections de Bucarest, elle fera l'objet d'une étude à part.

СИСТЕМА РУКОВОДСТВА СО СРЕДСТВАМИ АВТОМАТИЗАЦИИ ДЛЯ ЦЕНТРАЛЬНОГО УПРАВЛЕНИЯ ЭЛЕКТРОТЕХНИЧЕСКОЙ ПРОМЫШЛЕННОСТИ

В настоящей статье преследуется цель исложения как принципов, лежащих в основе разработки проекта, так и заключений экспериментирования его основных модулей на крайовском предприятии «Электропутере». Опыт, проведенный в бухарестском центральном управлении швейной промышленности, будет рассмотрен впоследствии.

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