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# The Organization of the Data Base in the Conception of an Integrated Informatic System at an Enterprise in the Chemical Industry.

*The automation of coding and processing stage of data, substantially reduces the implementing time of an informatic system.*

Data base planning of an informatic system can be fulfiled only when the objectives of the informatic system have been clearly established and when the applications which to assure objectives fulfilment have been minutely planned.

The main objectives of the planned informatic system consist in the automatic processing of data for: the efficient programming of production, the pursuit of fabrication, technical-material supply, the marketing of products, the administration of stocks.

The implementation of the following main applications was planned for the fulfilment of these objectives:

a) **Calculation of capacities**

The application aims at establishing the load resulting for the work posts, using as entry the plan drawn up by the enterprise managerial board. The resulting load is analysed by the managerial board which operates changes elaborating a new plan variant which includes solutions to exceptional situations: load over capacity, etc.

The new variant is again treated by this application. In conclusion, the application serves the managerial body for analysing the effect of the various plan variants and for choosing the best one.

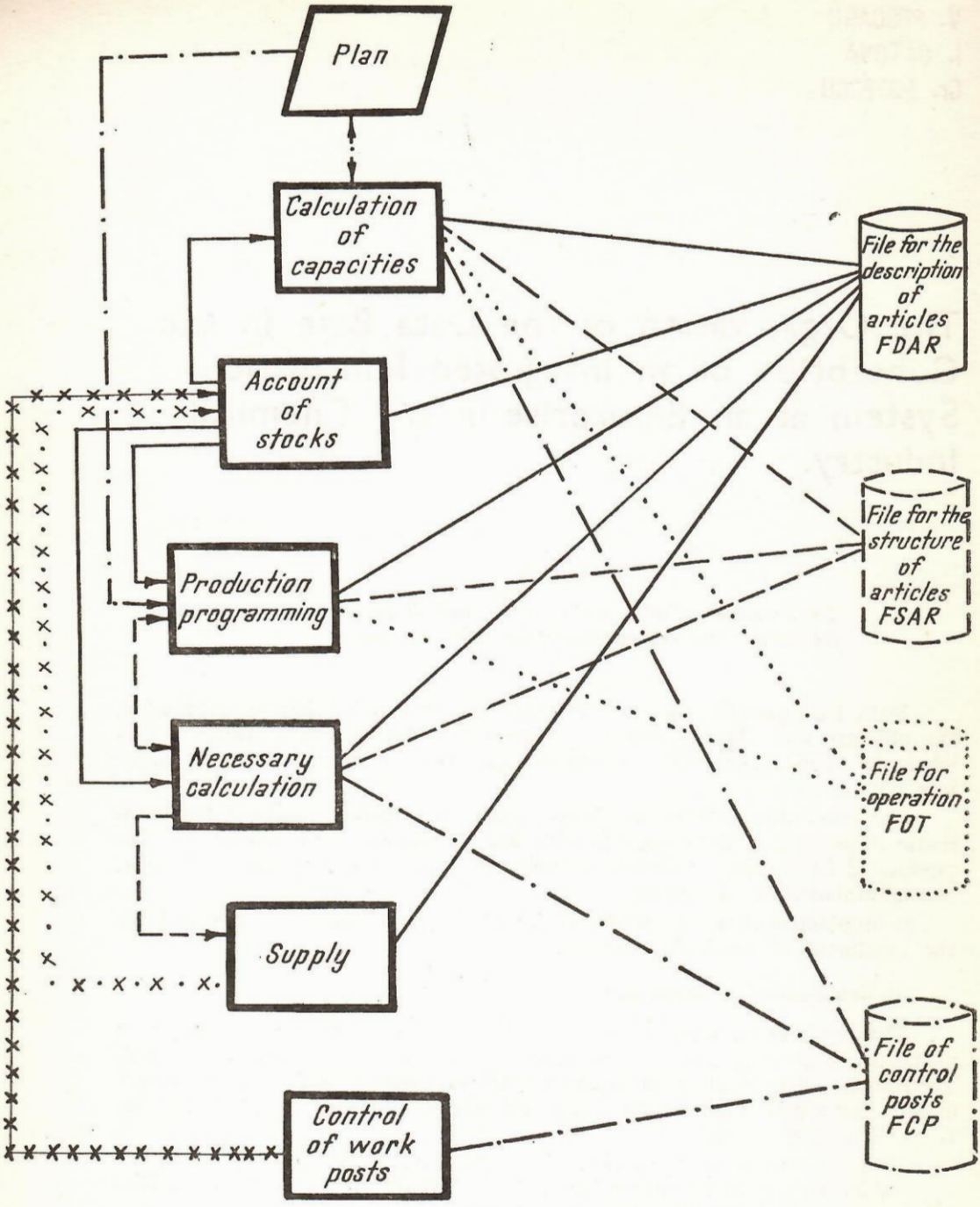
Plan
Calculation of capacities
Account of stocks
Production programming
Necessary calculation
Supply
Control of work posts
File for the description of articles FDAR
File for the structure of articles FSAR
File for operation FOT
File of control posts FCP

Figure 1

b) **Programming of production**

The application establishes the quantity of finite and semiproducts which has to be produced daily on workshops, sections, points of work and machines so that the fulfilment of the plan be ensured.

c) **Calculation of the outfit** — the application determines the necessary semi-products and raw materials for the achievement of a certain quantity of finished product. It is used by application "b" after the latter achieves the planning for finished products in view of planning the fabrication of the semi-products. This application established the necessary supply.

d) **Supply** — the application has the task to launch the supply orders with the suppliers and to keep the accounts of the entire supply activity.

e) **Control of work posts** — by using a data collection equipment, the application reports on the achievements of each workshop. Upon request, it gives an account of the situation of the production obtained in comparison with the plan targets on workshops, sections and points of work. The data supplied by this application on employees can be used for the calculation of wages.

f) **Account of stocks** — the application keeps the records of the stocks of raw materials and finished products.

## THE DATA BASE OF THE INFORMATIC SYSTEM

*Conception and Structure of the Data Base*

For an efficient implementation of the applications enumerated, it is necessary to put at the disposal of all these applications a single information storage, a system of programs which should organize this storage, bring it up-to-date and re-organize it and a system of programmes which should achieve the retrieval of the information in the organized storage. This ensemble forms the data base of the planned informatic system.

The information of the data base is organized in two types of files: the active files which effectively make the exchange of information with the applications and the passive files which have the role of registering the evolution in time of data or of achieving the reliability of the system by doubling the active files.

The main active files of the data base are the following:

— The file for the description of articles (FDAR) containing the characteristics of the finished products turned out in the enterprise, of the semi-products and raw materials used for their manufacturing.

— The file for the structure of articles (FSAR). It contains the relations existing among the articles described in FDAR, namely the technological structure of the products.

— The file for technological operations (FTO) containing the technological process for the achievement of semi and finished products.

— The file for the description of work posts (FWP). It contains the description of work posts, the manual or mechanized means of work with which they are equiped and their way of utilization in production.

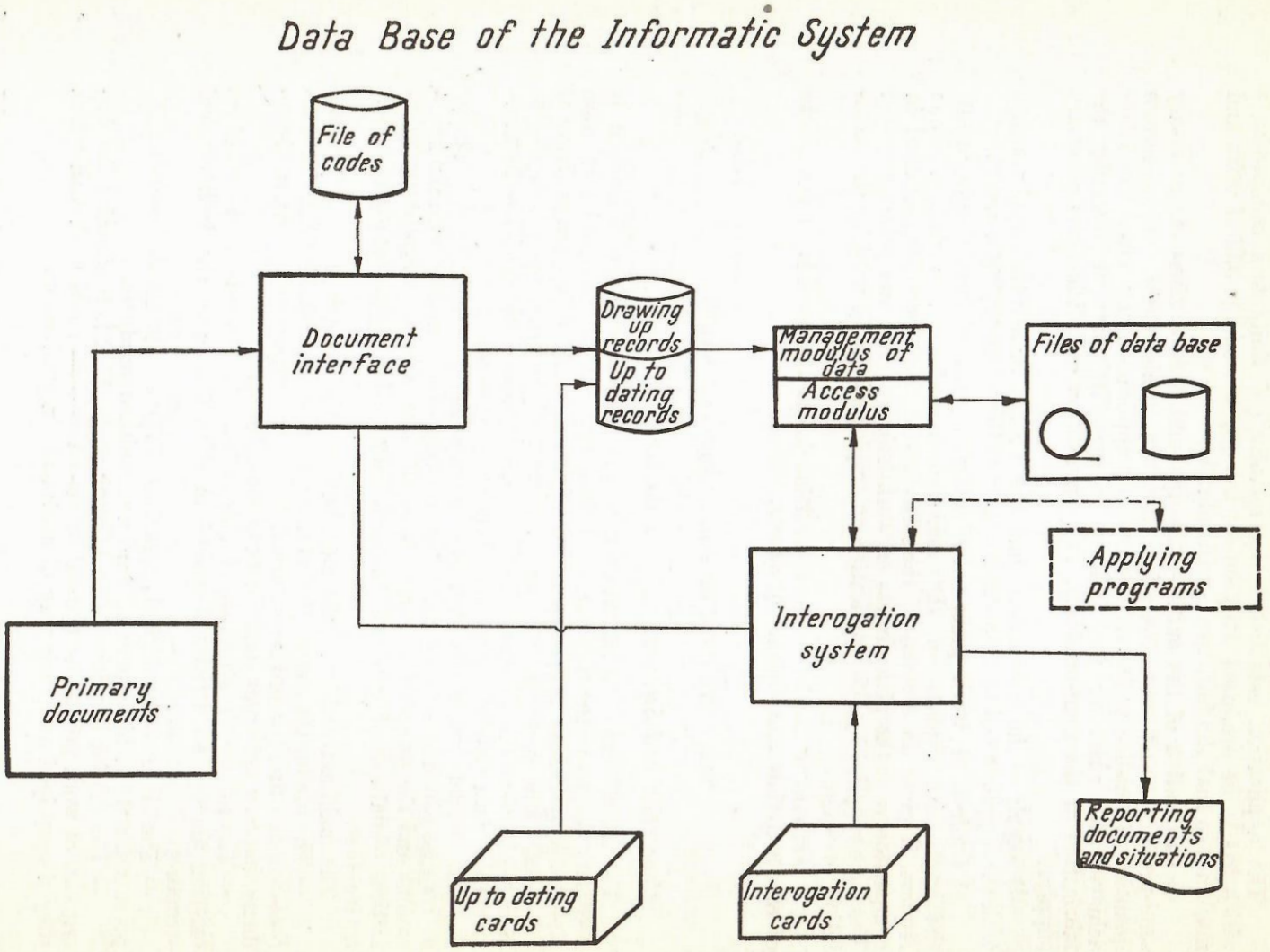
Data Base of the Informatic System
File of codes
Document interface
Drawing up records
Up to dating records
Management modulus of data
Access modulus
Files of data base
Applying programs
Interogation system
Primary documents
Up to dating cards
Interogation cards
Reporting documents and situations

Figure 2

Besides these active files which we shall call *technological files* and which are the main active files of the data base, it also contains as active files the file for supply, the file for suppliers, the file for personnel and the file for material orders.

Figure 1 illustrates the relations between the main applications of the system and the bilateral information flow between these applications and the main files of the data base.

Figure 2 presents schematically the data base of the planned system with its three component parts:

— the system of data programming, collection and organization.

— the data of the base organized in files.

— the programme system which achieves the retrieval of information in the files of the base (the interrogation system).

*Organization of Technological Data*

The solution adopted for the collection of technological data was that of achieving a programme system called "INTERFACE DOCUMENT" having the role of taking over the data directly from the source documents. The utilisation of the deck of BOMP programmes adapted to the necessities of the application was chosen for organizing these data into files.

The processing of data directly from the source documents is a particular characteristic of this application and this is the reason why the "INTERFACE DOCUMENT" system will be presented in detail.

*Up-to-dating of the Technological Files*

The up-to-dating of the technological files is being achieved in two variants: either by presenting the up-to-dating demands on source document models first treated by "INTERFACE" and afterwards the "BOMP" modules or by presenting the up-to-dating demands directly to the BOMP modules.

The first variant has the advantage of simplicity in presenting the up-to-dating demand and the fact that it is not necessary to know the code corresponding to the modified product.

The second variant has the advantage of a shorter time being necessary for making the change.

*Interrogation of the Data Base*

The interrogation of the data base is being achieved by a programme system called "INTERROGATION SYSTEM" which mainly answers two major demands: the carrying out of a bilateral exchange of data between the data base and the planned application and the supply of documents in the form of accounts of technological reports or specifications.

The reporting records may be divided into two categories: records supplied periodically (technical-operating, book-keeping, statistical and technological records) and exception reporting records supplied upon request with a view to substantiating the decisions which are to be taken under exceptional conditions (the lack of a raw material in the stock, the giving up of the manufacturing of a certain type of product, modifications in the plan, etc.).

The technological specifications supplied by the interrogation system represent documents which are being distributed at the places of work and according to which the entire technological process is taking place.

The interrogation system has the duty, upon making the change in a certain specification, to supply in an up-to-dated form, all the specifications affected by the change. These specifications will replace the old specifications.

This function of the interrogation system allows the research department of the enterprise to study new variants of technology and the multiple influences of the changes suggested by them.

The solution adopted for achieving the interrogation system was that to adapt the programme library deck "PRODUCT STRUCTURE RETRIEVAL" for partly satisfying the tasks incumbent on it and to draw up new programmes corresponding to the other tasks.

## PRESENTATION OF THE "INTERFACE DOCUMENT" SYSTEM

### *Necessity of the System*

The data to be introduced into the files of the data base are distributed in a number of documents used by various departaments of the enterprise.

As the data of these documents are not presented in a form appropriate to the loading of files, a stage is necessary for the preparation of data, consisting of the organization of the data taken over from the document according to the desired form which should constitute records for the loading or up-to-dating of the files within the data base. Moreover, at this stage, the coding of the articles is necessary if they were not attributed codes before.

The stage for the preparation of data in view of the setting up and up-to-dating of the files contained in the data base is very difficult, requiring a big volume of work, a fact which prolongues the period for the implementation of an integrate system.

This stage may be automatized by achieving a system of programmes which should have the role of interface between the documents of the user and the base administration modules. This system of programmes will have to take over also the function of the coding of articles, in keeping with a coding system elaborated by the user.

The existence of such an interface allows for a document to be stored in the files of the data base through the articles described by the document and the relations existing among the articles.

Taking into account the advantages of such an interface, it was achieved for the present application in the administration of the technological files.

### *Functions of the System*

Regardless of the application, such a system must fulfil the following three main functions:

— the automated coding of the articles by taking over the codes of the already coded articles;

— the exploration of the documents and the building of the loading records;
— the up-to-dating of data in the set up files by using as an entry documents on which the fields allowing the identification of the finished product and the fields the content of which has changed, are filled in.

The "INTERFACE DOCUMENT" system corresponds to these three demands, a fact which can be followed in Figure 3 which will be further commented in brief.

The main programme, simulating the optic reader, creats in the internl storage, the image of the data supplying document and gives the control of the checking programme for a number of positional and logical verifications.

After the image of the document is checked, the programme for the exploration of the document is controlled. The exploration is made in two stages:
— in the first stage, on the basis of the description of the complete structure of the finished product, contained in the exploration programme, the particular structure described in the document is identified and the articles identified on the basis of the initially established coding system are being coded. The data on the particular structure of the explored document and the codes of the articles are kept in a descriptive vector of the document;
— in the second stage, loading records for the files of the data base are built following the analysis of each element of the descriptive vector. The programmes describing what elemnts in the document participate in the formation of the loading records are contained in a file of the data base and are used both in the setting up of the files and in the editing of the documents after the retrieval of the articles making them up. The up-to-dating of data in the files is achieved by presenting on entry the model of the document on which only the fields allowing the identification of the finished product and the fields the value of which has been changed, are filled in.

The main programme creates in the storage the image of the thus filled in document, identifies the finished product and applies to a retrieval programme which completes the image of the document.

In continuation, the up-to-dating programme changes the fields for which new values were indicated, supplying the data administration modules with up-to-dating records. Both the document on the basis of which changes were demanded and the other documents affected by the respective change are supplied on exit, in an up-to-date form.

*Description of the Document Exploring Algorithm*

The document exploring algorithm is based on the fact that the complete description of the structure of the finished product is contained in the exploring programme.

To achieve this description, four types of instructions have been conceived, three types of 10 bits each and one type of 22 bits.

The type 1 instruction is an instruction for defining the article and it contains the type of the described article, the place or places in the document

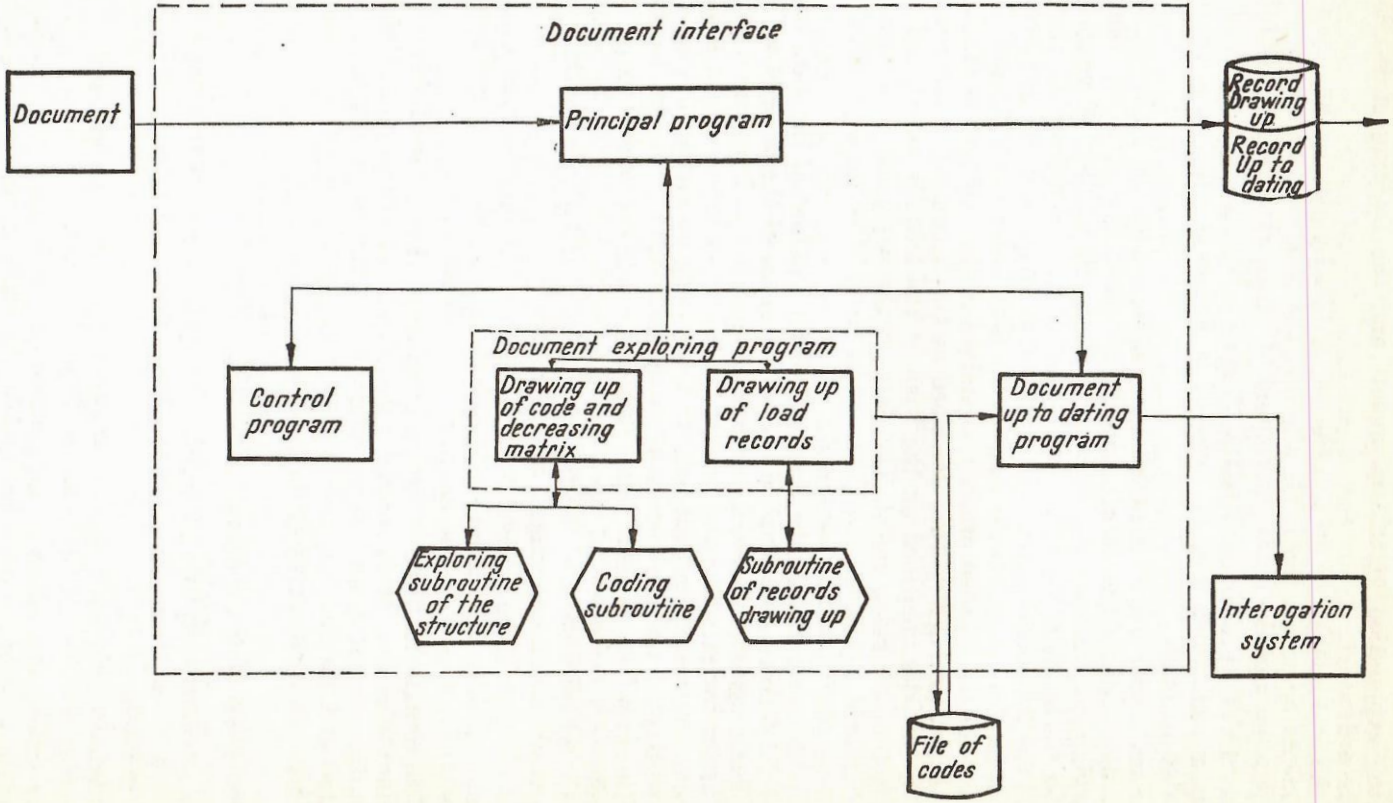
Document interface
Document
Principal program
Record drawing up
Record up to dating
Control program
Document exploring program
Drawing up of code and decreasing matrix
Drawing up of load records
Document up to dating program
Exploring subroutine of the structure
Coding subroutine
Subroutine of records drawing up
Interogation system
File of codes

Figure 3

in which it is described and the address of the next instruction to be carried out.

The type 2 instruction is used to cover a branch of the structure which has already been described. It contains the address of the continuation instruction after covering the structure branch and the addresses of the start and end instructions of the structure branch.

The type 3 instruction is meant to change the level digits of the items in a structure branch. The identical structure branches appearing at various levels in the arborescent structure are described once, with the level digits of a lower value. The instruction contains the changing element of the level digits and the addresses of the start and end instructions of the structure branch.

The type 4 instruction is used for choosing between two branches of the structure following the test of the value of a field in the explored document, consequently it achieves the particularization of the general structure.

The instruction contains the type of the test (simple or cyclic), the character with which the comparison is made, the length of the tested field, the period of the cyclic test, the working level of the test, the place in the document in which the tested field, the mask of the test and the address of the structure branch which will be chosen in case of equality or inequality of the compared fields are to be found.

Thus, on the basis of these instructions which describe the product, the particularization of the general structure to that described by a certain document is achieved.

In continuation, this particular structure is being covered and loading records are built for the technological files. The load is achieved only for the significant records, the repeated record being eliminated.

*Preoccupations for Generalizing the "INTERFACE DOCUMENT" System*

The "INTERFACE DOCUMENT" system was conceived to be used in the processing of any type of document. In the present form, however, the way in which the particularities of the application are indicated (the description of the fields of the document, of the general arborescent structure, of the coding system and of the load or up-to-dating records) is difficult, because it is made at a machine code level. For this reason, a formal language is being now conceived which should allow an easy description of the parameters of the problem and of a related compiler.

## CONCLUSIONS

We shall present in the form of conclusions, the main aspects of the activity presented in this material which we have kept as an experience for future similar activities: a) the tackling, in the designing stage, of the solution of taking over the data directly from the documents, has given the expected

flexibility to the data base, yet, it did not lead us to time saving because of the considerable effort required for conception and programming.

This solution is convenient to be tackled also from the point of view of time, in case that a deck of programmes is used, which is to be adopted by parametrization, a deck which we intend to achieve by generalizing the presented one and to use it in the following applications.

Among the parameters to be supplied to the user, the system of validation of the data to be introduced in the data base is of particular importance. It is absolutely necessary that besides the checkings incumbent on this system, a comparison should be made of the source documents with the documents supplied by the interrogation system.b) The solution to achieve the programmes of a partial data base by adapting the library programme decks (BOMP and RETRIEVAL) made us reduce the programming effort by about 30 per cent. This percentage is lower than that provided initially (50 per cent), and we consider that it depends, to a great extent, on how the personnel was trained in the field of programming by the beneficiary. We affirm this because, on the one hand, the adaptation of these decks requires good knowledge of the ASSEMBLER programming language and of the operating system (it should thus be made by specialists in the subject), and on the other hand, the interrogation system should be achieved, to an ever greater extent, with the beneficiary's own forces. It is necessary, because the interrogation system is the "key point" to be mastered by the beneficiary for ensuring independence and maximum of efficiency in the exploitation of the data base. He must know to operate the necessary changes in the way of presentation or in the content of the reporting records, he must know how to demand new reporting records.

If efforts are not made for ensuring this independence, the assistance tasks of the specialists in the testing and exploiting period are growing unjustifieldly.

As the beneficiary did not dispose of good experts in the ASSEMBLER language and as we wanted to satisfy the above-mentioned necessity, the solution resorted to was that the beneficiary should achieve a number of component parts of the interrogation system in the COBOL language, component parts which could be obtained as variants of the modules of the "RETRIEVAL" deck.

This has resulted, on the one hand, in the diminishing of the contribution of the "RETRIEVAL" programme deck and, at the same time, the diminishing, to a certain extent, of the performances of the interrogation system.

c) Taking into account the fact that the performances of the interrogation system determine, to a great extent, the performances of the entire system, great importance should be granted to the data retrieval algorithms.

Generally, these algorithms need certain zones in file registration and consequently, the necessity of establishing the retrieval algorithms on planning the registration of the data base files.

For the application presented, both the algorithms conceived by us and those used by the "RETRIEVAL" deck need such zones.

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## ORGANISATION DE LA BASE DE DONNÉES DANS LA CONCEPTION D'UN SYSTÈME INFORMATIQUE INTÉGRÉ, DANS UNE USINE DE L'INDUSTRIE CHIMIQUE.


On présente la modalité de concevoir la base de données du système informatique projeter pour une usine de l'industrie chimique.

La première partie comprend les objectifs du système informatique et on présente, de manière sommaire, les applications projetées pour leur réalisation.

Ensuite, on présente la base de données, insistant tout spécialement sur la présentation d'un système de programmes réalisé par les auteurs pour le recueille automatique des données dans les documents, et leur codification.

Aussi, on présente les solutions choisies pour organiser les données en fichiers et pour interroger la base de données.

Dans la dernière partie on met en évidence les éléments que les auteurs considèrent comme étant utiles à retenir pour des futures activités similaires.

# ОРГАНИЗАЦИЯ БАЗЫ ДАННЫХ В КОНЦЕПЦИИ ИНТЕГРИРОВАННОЙ ИНФОРМАТИЧЕСКОЙ СИСТЕМЫ НА ЗАВОДЕ ХИМИЧЕСКОЙ ПРОМЫШЛЕННОСТИ

В настоящей статье представляется концепция базы данных для информатической системы, проектируемой для завода химической промышленности.

В первой части статьи излагаются цели информатической системы и кратко представляется проектируемое применение для их осуществления.

Далее представляется база данных с особым упором, в частности, на представление системы программ, осуществленной авторами для работы по отбору данных из документов и по кодированию.

Указываются также выбранные решения для организации картотек данных и для получения данных от базы.

В заключительной части выявляются элементы, которые, как считают авторы, целесообразно отметить для будущей подобной деятельности.