N. COSTAKE

The First Stage of the National Data Processing System Development

The directives of the Xth Congress of the Romanian Communist Party provide for the gradual establishment of a national system of data processing. A long-range programme has been adopted to this end; its first stage refers to the 1967—1975 period.

The implementation of the national data processing system *) supposes a rather great number of activities orientated towards several main directions: creation of proper production development, maintenance and repair basis of information processing equipment, endowment of the peripheral zone (information collection) and of the central zone (information processing) of the system, creation of the basis required for system conception (drawing up and development of main processing program systems, design of the system as a whole and of the computing centres), required measures of organization and so on.

This paper will deal particularly with the design of the data processing unitary system only for the central zone (in other words, with the use of computers). The results are based on pilot computations, with a view to establish the order of magnitude. It presents the results of a study carried out by the author, containing personal views, not related to oficial data and/or decisions.

Sizing the system raises, mainly, the following problems:

— choice of the fields of activities to be endowed with computers in the first stage considered;

— estimation of the probable economic effects;

— estimation of the required processing capacity;

— study of the equipment technical-economic characteristics;

*) The term used in the programme is that of "unitary data processing system".

— recommendation of solutions for system implementation (hardware and software);

— detailed planning.

The priority fields in the first stage are: the planning at the level of national economy, the economic information system, the supply system, the management and production control of big economic units; the financial and banking system and the design activity.

The estimation of the probable economic effects requires deep, multilateral analyses. A study based on electronic simulation, as well as direct estimation of the orders of magnitude suggests a very important economic potential, in other words the possibility of an achievement of great economic efficiency.

The estimation of the required processing capacity can be achieved by analyzing the equivalent information system. The principle of estimation is shown in Fig. 1. The indicated relationship is approximate and has to be compared

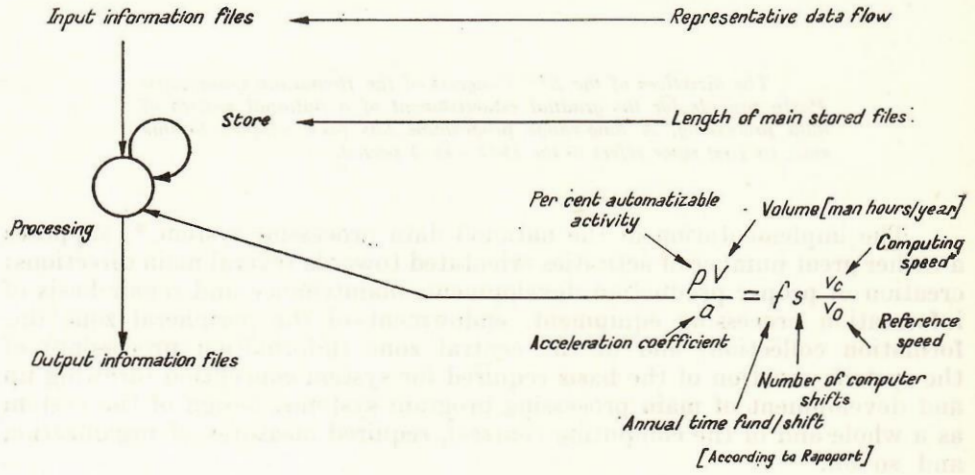


Fig. 1

to results based on the system analysis of representative information processing. Dynamic analyses are also necessary (conditions of efficient compensation for the main perturbation); in the particular case of metal supply control system such analyses show the interest in creating a sub-system able not only to achieve an efficient stock control but also elaborate the production plan of the main iron and steel plants for about two weeks within a 1—1.5 year planning horizon. The gross results of such estimation are given in Fig. 2 total equivalent speed of computation) and in Fig. 3 (information output and external store for the chosen priorities. For simplicity figure 3 has been drawn in the form of a simplified equivalent information system. Particular emphasis is to be given to the data collection system, the mean aproxi-

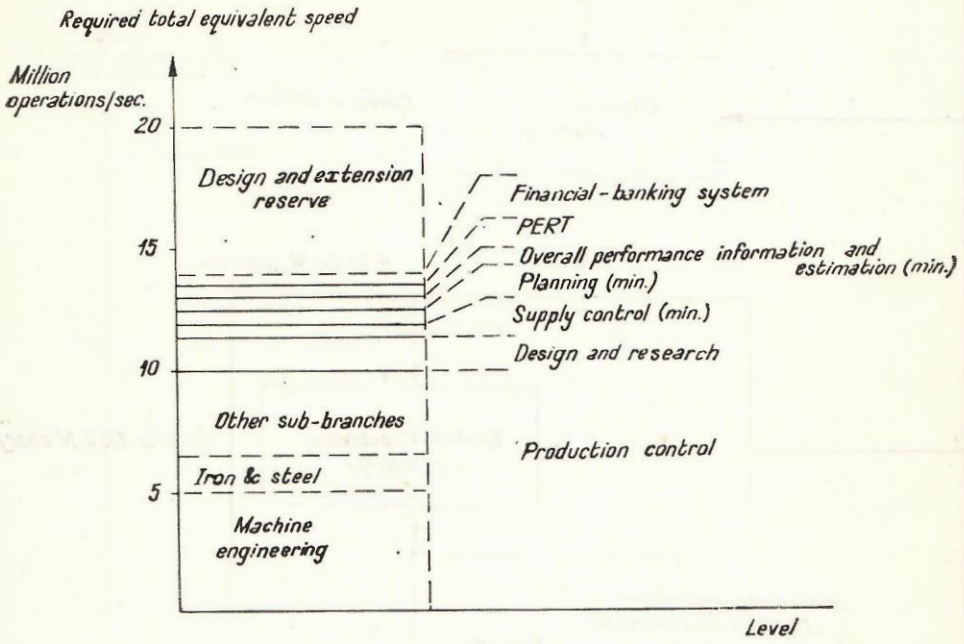


Fig. 2.

mate curves for the case of the machine-building units being shown in Fig. 4.

It follows that, on the whole, it is necessary to create, in the first stage considered, an overall computing speed of about 20 million operations/sec. *)

Technical-economic characteristics of digital electronic equipment for information processing **). The ratio cost/performance may vary considerably, depending on the nature of the application (for example, in Fig. 5 the mean cost-time curve required to update 10 per cent of a series of 10,000 records is shown, and in Fig. 6 the mean cost-time curve for matrix inversion in shown.)

The mean curve of the cost of numerical electronic systems for information processing has the characteristic aspect shown in Fig. 7.

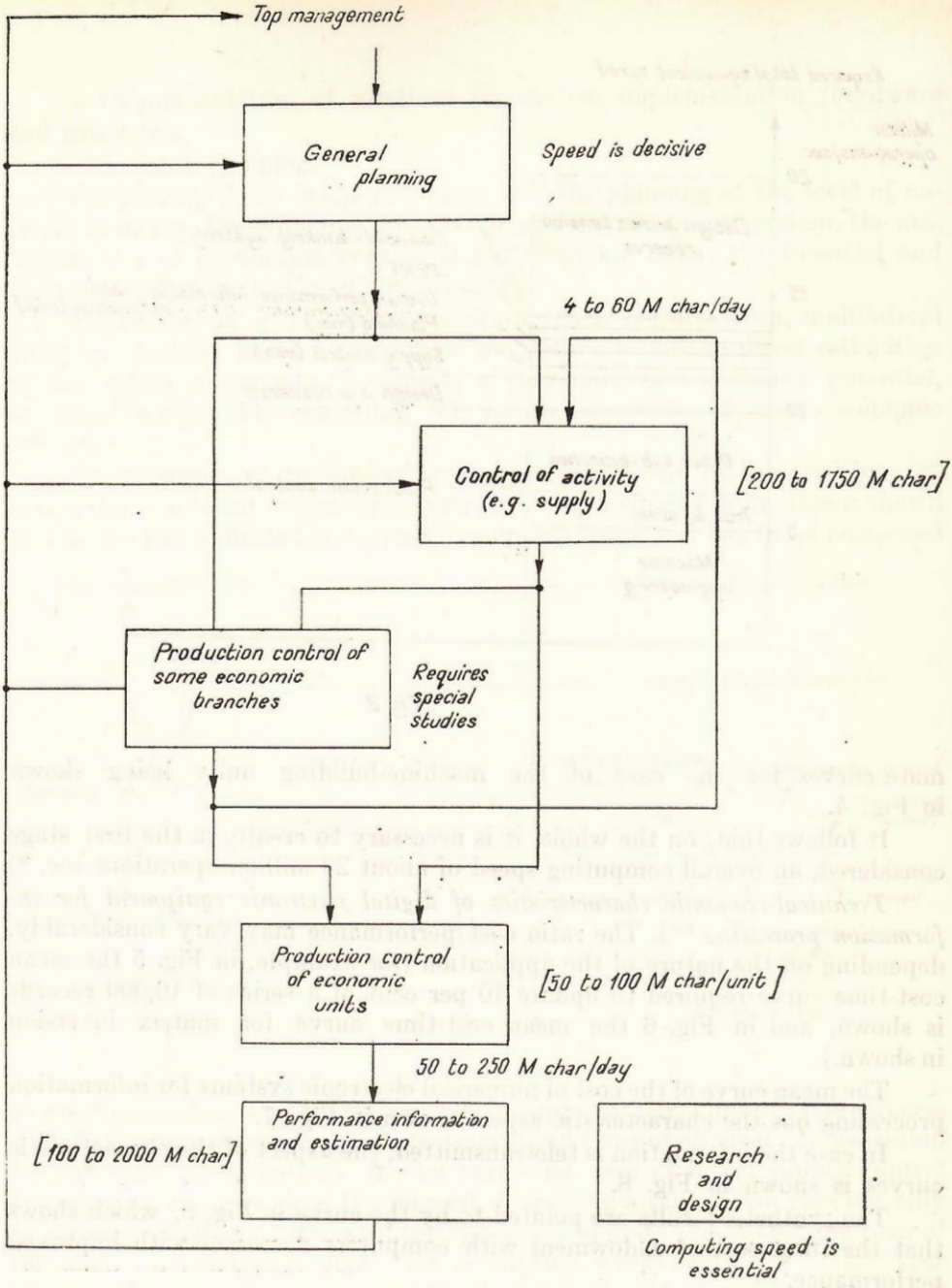
In case the information is teletransmitted, the aspect of the characteristic curves is shown in Fig. 8.

The synthetic results are pointed to by the curve in Fig. 9, which shows that the total cost of endowment with computers decreases with improved performance.

---

*) Utilized in the sense of complete addition in fixed point/sec.

**) The computation is mostly based on mean costs and perfo rmances indicated in the *Auerbach Standard EDP Reports*, vol. I.



M. char. = Million characters
[ ] External store

Fig. 3.

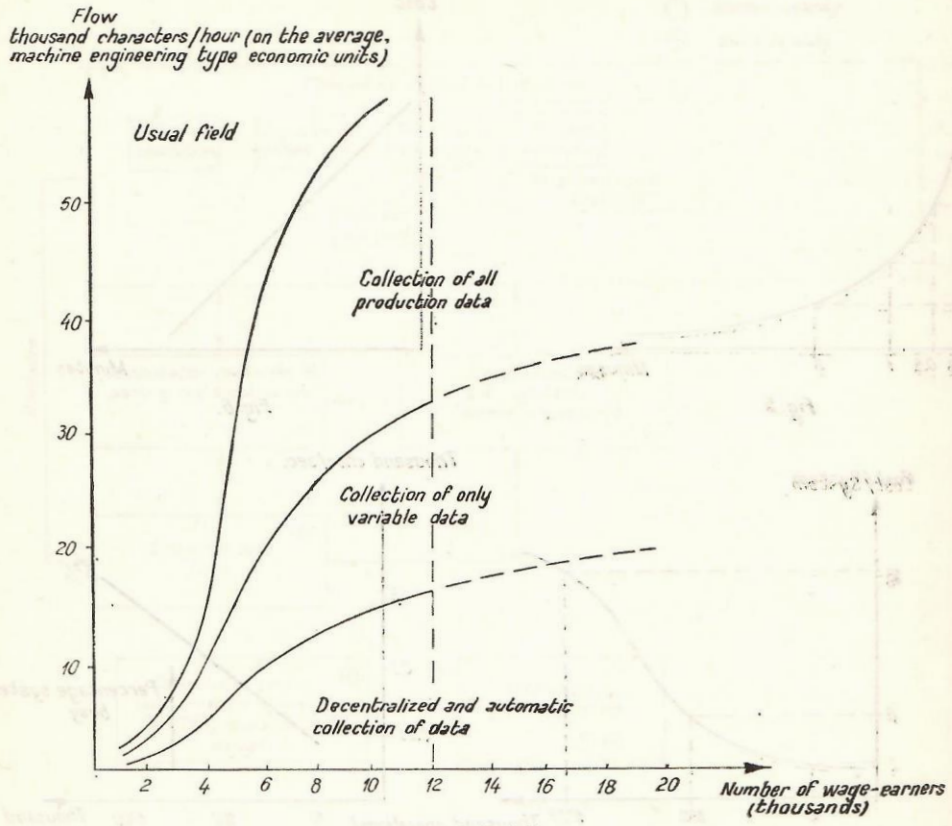


Fig. 4.

This result confirms the provisions of the endowment programme according to which the organization of the system should be directed in view of ensuring maximum economic efficiency at the level of the whole economy. The degree of integration which internal manufacturing should reach in view of providing a cost price similar to that resulting from importation is shown in dotted lines, in the same figure. There results that for an endowment consisting mainly of computers of about 100,000 operations/sec, the advisable degree of integration is 50—55 per cent *).

Thus, in view of achieving efficiency in the national data processing system, it is necessary to consider the problem in its whole, import being interesting mainly for large processing capacities.

Concomitantly, there result the economic interest in constituting relatively powerful territorial centres of electronic computation, and the interest, at least in principle, in automatic teletransmitting of information.

*) Since the possible effects of co-operation in manufacturing have not been taken into account, a smaller required degree may be expected in reality.

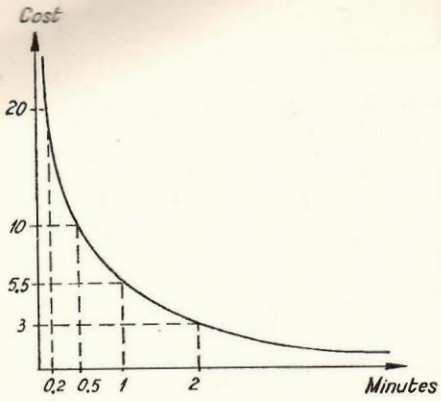


Fig. 5.

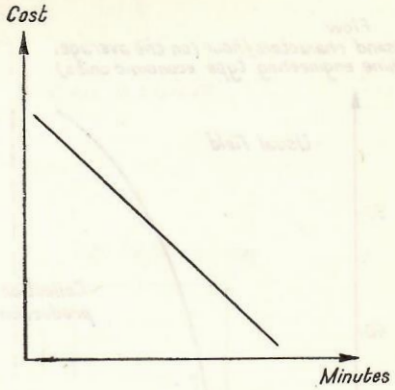


Fig. 6.

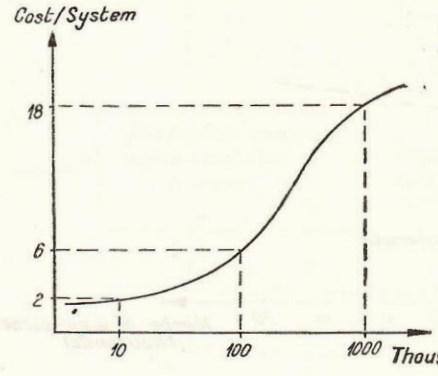


Fig. 7.

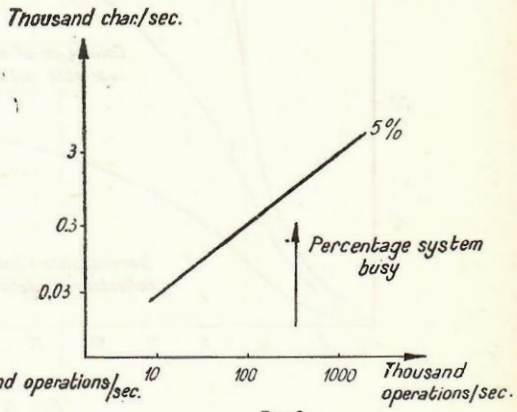


Fig. 8.

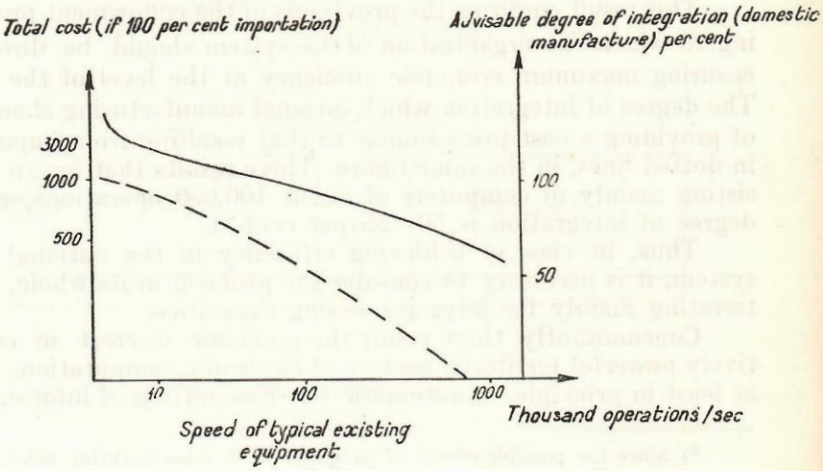
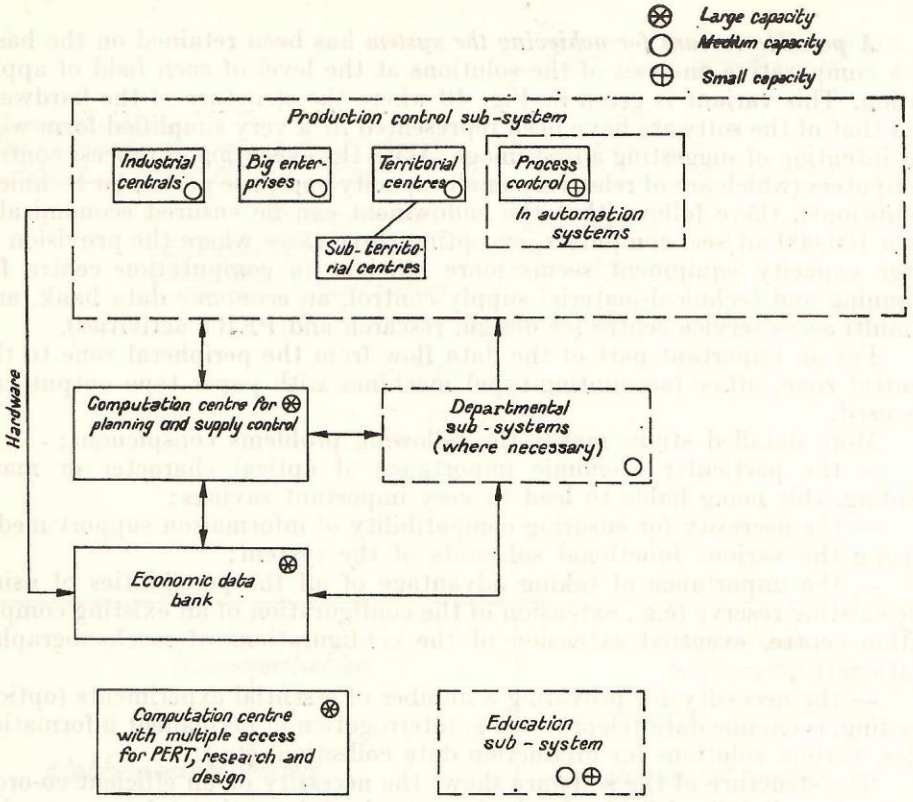


Fig. 9


Large capacity
Medium capacity
Small capacity
Production control sub-system
Industrial centrals
Big enterprises
Territorial centres
Process control
In automation systems
Sub-territorial centres
Hardware
Computation centre for planning and supply control
Departmental sub-systems (where necessary)
Economic data bank
Computation centre with multiple access for PERT, research and design
Education sub-system

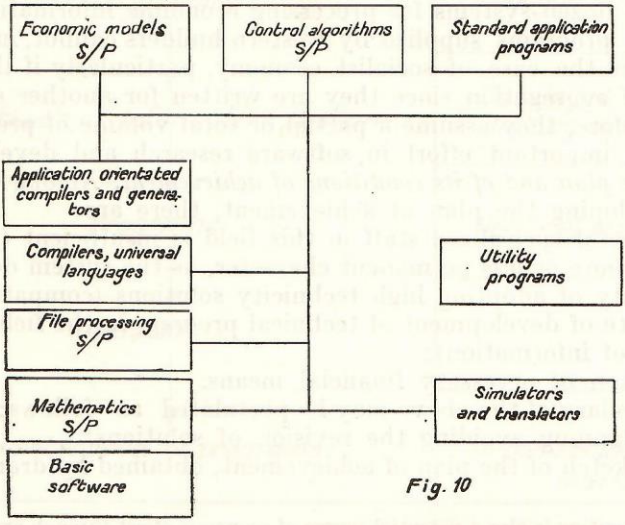

Economic models S/P
Control algorithms S/P
Standard application programs
Application orientated compilers and generators
Compilers, universal languages
Utility programs
File processing S/P
Mathematics S/P
Simulators and translators
Basic software

Fig. 10

A possible variant for achieving the system has been retained on the basis of a comparative analysis of the solutions at the level of each field of application. This variant is given in Fig. 10 where the structure of the hardware and that of the software have been represented in a very simplified form with the intention of suggesting a first image. With the exception of process control computers (which are of relatively small capacity and raise particular technical conditions), there follows that the endowment can be ensured economically with 100,000 ad/sec. computers, excepting three cases where the provision of large capacity equipment seems more efficient (a computation centre for planning and technical-material supply control, an economic data bank, and a multi-acces service centre for design, research and PERT activities).

For an important part of the data flow from the peripheral zone to the central zone, office (accounting-type) machines with paper tape output can be used.

More detailed study makes the following problems conspicuous:

— the particular economic importance of optical character or mark reading, this being liable to lead to very important savings;

— the necessity for ensuring compatibility of information support media among the various functional sub-units of the system;

— the importance of taking advantage of all the possibilities of using the existing reserve (e.g., extension of the configuration of an existing computation centre, eventual extension of the configurations of mechanographic stations);

— the necessity for providing a number of essential experiments (optical reading, economic data teleprocessing, interrogation of permanent information files, various solutions for production data collection, etc.).

The structure of the software shows the necessity of an efficient co-ordination in well defined fields. In the framework of the national data processing system it becomes essential for the activity of program elaboration to acquire an industrial character. *) More detailed consideration stresses the convenient existence of a few dozen systems for processing economic information. Economic application programs supplied by western builders cannot, in general, be used as such in the case of socialist economy, particularly if they refer to higher levels of aggregation, since they are written for another economic enviroment. Therefore, they assume a partial or total volume of proper conception, hence an important effort in software research and development.

Problem of the plan and of its conditions of achievement. Among the main premises for developing the plan of achievement, there are:

— the number of specialized staff in this field is insufficient (probably a restriction of a more or less permanent character, as the system develops);

— the necessity of adopting high technicity solutions (compatible with the remarkable rate of development of technical progress in the field of electronic processing of information);

— the provision of necessary financial means.

Thus, the corollary of the above may be postulated as follows: detailed and systematic planning avoiding the revision of solutions.

An outlined sketch of the plan of achievement, obtained by dramatically

*) The software writing is also a potential source of economic effect through export.

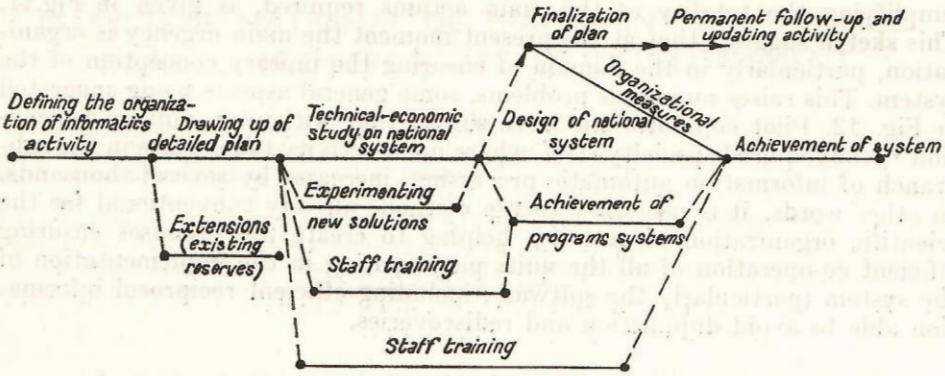

Finalization of plan
Permanent follow-up and updating activity
Organizational measures
Defining the organization of informatics activity
Drawing up of detailed plan
Technical-economic study on national system
Design of national system
Achievement of system
Experimenting new solutions
Achievement of programs systems
Extensions (existing reserves)
Staff training
Staff training

Fig. 11

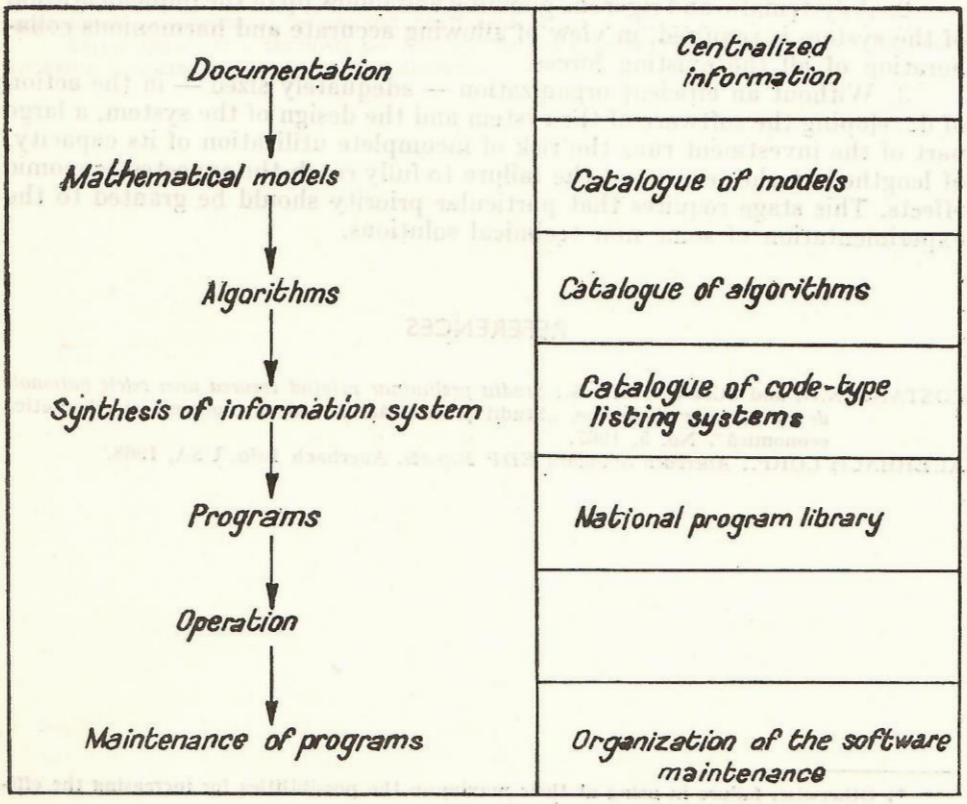

Documentation
Centralized information
Mathematical models
Catalogue of models
Algorithms
Catalogue of algorithms
Synthesis of information system
Catalogue of code-type listing systems
Programs
National program library
Operation
Maintenance of programs
Organization of the software maintenance

Fig. 12

simplifying the totality of the main actions required, is given in Fig.11. This sketch suggests that at the present moment the main urgency is organization, particularly in the domain of ensuring the unitary conception of the system. This raises numerous problems, some general aspects being suggested in Fig. 12. Pilot computations have shown that without a unitary conception *) the required specialty staff, whose main activity takes place in the subbranch of information automatic processing, increases by several thousands. In other words, it is necessary to use methods already conventional for the scientific organization of activity, helping to create the premises ensuring efficient co-operation of all the units participating in the implementation of the system (particularly the software, including efficient reciprocal information able to avoid duplication and rediscoveries.

CONCLUSIONS

1. The rapid creation of the national data processing system requires the consideration of the problem at the level of the national economy as a whole and the utilization of up-to-date conditions (multiple access, optical reading, etc.). Starting the design of this system according to the provisions of the endowment programme is of vital importance.

2. A systematic and rigorous planning and follow up of the implementation of the system is required, in view of allowing accurate and harmonious collaboration of all the existing forces.

3. Without an efficient organization — adequately sized — in the action of developing the software of the system and the design of the system, a large part of the investment runs the risk of incomplete utilization of its capacity, of lengthening the terms and the failure to fully reach the expected economic effects. This stage requires that particular priority should be granted to the experimentation of some new technical solutions.

REFERENCES

COSTAKE N.N. and SCHÄCHTER S.: *Studiu preliminar privind crearea unei rețele naționale de calculatoare electronice.* „Studii și cercetări de calcul economic și cibernetică economică". No. 5, 1967.

AUERBACH CORP.: *Auerbach Standard EDP Reports.* Auerbach Info, USA, 1968.

*) Otherwise, failure in using at their maximum the possibilities for increasing the efficiency characteristic of the socialist systems.

LE SYSTEME NATIONAL DE TRAITEMENT DES DONNEES DANS LA PREMIERE ETAPE DE DEVELOPPEMENT

Prenant comme point de départ le programme de nantissement de l'économie nationale avec des équipements de calcul pour l'étape 1967—1975, l'auteur envisage les principaux aspects de l'édification du système national de traitement des données.

Les problèmes principaux pris en considération se rapportent aux courbes de prix total, à la structure des principaux sous-systèmes, à l'énonciation des principales options techniques, à l'importance de l'organisation centralisée de l'activité de conception.

L'auteur aboutit à la conclusion que le programme de nantissement envisage toutes les conditions nécessaires au développement de ce système.

НАЦИОНАЛЬНАЯ СИСТЕМА ПЕРЕРАБОТКИ ДАННЫХ НА ПЕРВОМ ЭТАПЕ РАЗВИТИЯ

Исходя из программы оснащения народного хозяйства вычислительными устройствами на 1967 — 1975 гг., автор затрагивает важнейшие аспекты создания национальной системы переработки данных.

Рассматриваемые важнейшие вопросы касаются кривых общей себестоимости структуры важнейших подсистем, изложения важнейших технических решений, значения централизованной организации творческой деятельности.

Автор приходит к заключению, что программа оснащения предусматривает все необходимые условия для развития этой системы.