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The Role of Data Banks in the Contemporary Information Systems

The paper underlines the necessity of extending the use of data banks as a sure and efficient way for a high perfection of the contemporary information systems and respectively for the satisfaction to a greater extent of the users' demands. The data banks are presented also as a solution in ensuring an adequate degree of integration of the information systems beside the outlining of the trends of research in elaborating the administration systems for data banks.

1. THE RAPID DEVELOPMENT OF INFORMATICS

The extremely rapid development of informatics in the world, its dissemination in a wide range of fields of activity has made evident both the high efficiency of electronic computers in the activity of scientific research, management, design and production of material goods and services and their stimulating role in the development of these activities. It is difficult to find at least one contemporary achievement of prestige which should not be based on the use of the electronic computer, as well.

In our country, the special Programme on the improvement of the socio-economic information system based on the introduction of information in the 1971—1980 period, a programme approved by the Party higher leadership in 1971 as well as the previous Programme of 1967 have laid the foundations of a rapid development of the autochtonous production of automatic data processing equipment, of the design and use of informatic systems. At present, we produce several types of electronic computers with appreciable technical and exploiting characteristics, which has allowed for the organization and commissioning in the previous and present five-year plan periods of scores

of electronic computing centres at all economic ministries, at the central synthesis bodies, at the industrial groups, in counties, in higher and secondary education, at plants and big enterprises, at research and design institutes, etc. At present, informatics boasts a considerable human potential, reaching 40,000 specialized staff (except for the working people of the data processing equipment building factories). The forecast for 1985 estimates a number exceeding 70,000 specialists in informatics. Over 1,500 socio-economic units are currently using electronic computers in their activities and the number of economic units to benefit indirectly from the results of electronic data processing is of tens of thousands.

In this respect, we can mention the works on the substantiation, elaboration and control of the carrying out of the single national plans, at various organizational levels as part of which the use of electronic data processing systems holds an important share.

These particular results (only some of which have been underlined here) obtained in the past ten years, in the rapid development of informatics in our country are mainly due to the correct orientations, scientifically substantiated, set by the Party and State superior leadership, to the policy of alloting important funds to this field of activity, to the creation and development of the research base and of the autochtonous production of data processing equipment, to the priorities and importance given in the training of specialists.

The remarkable results obtained so far in the development of informatics in our country ensure the conditions necessary for passing on to a new, qualitative stage, characterized especially by the particular stress laid on the elements of the efficiency of this activity, by the need of reducing the designing-implementation cycle of the informatic systems, the cost of these activities as well as that of the electronic data processing, which implies a better use of all the categories of resources for informatics (specialists, data processing and teleprocessing equipment, the conceptual instruments for using this equipment, the data which are processed). This new stage in the development of informatics in our country also pursues a greater impact in the management activity at various levels, respectively in planning, recording, organization, control, in the research and designing activities, in education, in the sphere of material goods and services.

... "The modern methods of computation and informatics" — Nicolae Ceaușescu, General Secretary of the Romanian Communist Party underlined in the exposition made at the opening of the Colloquy on the problems of the science of management of society, "undoubtedly have a particular importance, but, they can give adequate results only if they are integrated into a correct general outlook on the management activity, based on a thorough knowledge of the laws of social development, on a thorough examination of reality".

The special advantages offered by our socialist society will have to be used to a greater extent also in informatics by speeding up and extending the transfer of advanced technologies and experience between the computation centres, by enhancing the role and capacity of the national library of programmes so that we take a greater advantage of the unitary endowment

of the economy with computation technics, by the actual and efficient commissioning of branch, territorial and department macroeconomic informatic systems based on data and teleprocessing banks, on computer networks.

2. THE ROLE OF DATA BANKS IN FULFILLING THE NEED OF INTEGRATION OF THE INFORMATION SYSTEMS

2.1. *The tendency of disintegration in certain information systems*

The rapid development of the socio-economic activity alongside the important increase in the complexity of this activity, is leading, as is known, to a more marked specialization and, consequently, to the amplification of the number of structure elements in the contemporary systems. The organizational schemes of structure of various systems are amplified and become more complicated, the necessity for their change appearing more and more frequently.

The need of ensuring a constant and efficient control by the managerial body of the condition parameters of the entire system comes up against ever greater and ever more frequent difficulties generated by the amplification of the number of structure elements, by increasing number and complexity of the functional and informational connections between the elements of the given system, on the one hand and the (vertical and horizontal) connections with other systems, on the other hand.

Considering the organic interdependence between the activity of a socio-economic unit and its information system, the tendency of amplifying the structure elements in the basic systems is also propagated into the contemporary evolution of the information systems corresponding to them.

The continuous increase of the volume of data to be collected, transmitted, verified, processed and used, etc. in the contemporary socio-economic systems through the maintenance or rather the shortening of the reply time of the information systems, under the conditions of preserving the traditional data processing methods and techniques is inevitably leading to the amplification of the compartments, groups and number of staff dealing with routine operations in this processing process. It is logical because in comparison with the previous period a greater number of data processing operations must be achieved in an equal or shorter period of time.

Within such a process, permanently influenced by the need of reducing time, the activity is organised in parallel work groups and flows; the necessity appears for the same input data (partial or total) to enter simultaneously several compartments and, processing flows, respectively, thus reaching a high degree of disintegration of the respective information system.

At the same time, the volume of the information redundant from the system is more and more amplified not so much because of forms bearing data inadequately conceived but, in the first place, rather due to the conception of the respective information system, of the outmoded methods and techniques which continue to be used. A similar situation may occur even in those cases when electronic processing is used in a conception of a simple replacement

of some computation operations which were previously done manually or mechanized and/or operations with a very big share of edits.

The efficiency of the introduction and wide-scale use of electronic computers in the contemporary information systems is indispensably linked with the redesigning and reorganization of the information systems which are meant to ensure a qualitative transformation of these systems in keeping with the users' present and future demands and with the great technical and exploiting possibilities offered by the electronic computers and teleprocessing systems.

2.2. *The integrated information systems and the data banks*

The scientific preoccupations in solving the existent contradiction between the necessity for a permanent control over the condition parameters of the whole system, in continuously increasing the efficiency of the information system, on the one hand, and the tendency of its disintegration, on the other hand, have led to the conception of integrated information systems based on the use of electronic computers. Dialectically, the integrated information systems represented a solution of reply to the tendency of disintegration which is accentuated within these systems.

The conception of the achievement of integrated information systems mainly pursues the fulfilment of three tasks:

1) the integration of the information system from the point of view of its structure, the information flows, of the ensurance of a compatibility between the input and the output data, of the elimination (or, if it is the case, of control) of the redundant information, which implies the knowing of the relations between the data and the exercising of their control;

2) the organic integration of the information system into the socio-economic activity of the given system, into the activities of management and execution, the organic integration into the structure of the basic activity.

3) the organic integration into the respective information system of those data processing and teleprocessing methods and techniques which can satisfy the demands for a complex and intensive data processing, the conditions for an operative remote data input and/or output (an interactive working system), a minimum consumption of resources, respectively a minimum cost per unit of processed data, etc.

Under the conditions of the present complexity of the information system, of the big volume of data to be collected, transmitted, processed, stored and used, of the reply time of these systems which must be constantly reduced, the achievement of integrated information systems cannot be conceived without the use of electronic computers and teleprocessing systems, without specialized systems for data banks. The data banks — it can be said — have appeared as an objective necessity in the evolution of the contemporary information systems. They have been conceived and implemented for satisfying to an ever greater extent the demands imposed by the achievement of integrated information systems.

The complex requirements imposed on the contemporary information systems have led to the necessity of taking into account, in designing the informatic systems, the desideratum that several users have access to the

same data collection and the organization of data be made so as to satisfy in best condition the requirements of an operative processing and information, specific to each user. Thus, the necessity appears of a qualitatively higher correlation between the methods and techniques of data organization and processing, on one hand, and the great technical possibilities of exploiting the electronic computers and users' complex demands, on the other hand.

The further use of the techniques and methods of data organization and processing is inevitably leading to an increase in the volume of redundant data in the respective electronic processing systems, as a result of the solution of representation of the same data in two or several files, in keeping with various application programmes, in order to more rapidly answer the users' various and demands in addition to answer the requirements of reducing the processing time. Consequently, in such cases, the tendency of disintegration of the information systems is also transferred to the electronic processing systems.

The qualitative leap in the methods and techniques of data organization and electronic processing by which a high level of control and minimizing of redundancy in data representation have been achieved, and the possibility of representing both the data and the intrinsic relations between them has been ensured as a result of the use of methods and techniques specific to integrated files, has laid the theoretical and applicative foundations of a stage in the passing to the designing, organization and use of data banks.

It should be underlined that the data banks represent one of the most intelligent and efficient creations of informatics meant to satisfy the growing requirements of the users of the contemporary information systems. In this way, the data banks are not a simple variant of the existent electronic data processing systems, but, they represent a new qualitative stage in the evolution of the informatic systems. This new stage which can be called "the stage of data banks" is characterized by the turning to best account of the theoretical and applicative accumulations registered in the methods and techniques of data organization and use, in the standardization and automation of the technological operations of data processing in the teleprocessing systems, etc.

Thus, among the qualities offered by the informatic systems based on the use of data banks, we can mention:

— the sensible leap registered in securing the users' demands both as regards the shortening of the reply time of the respective information systems, thus, the considerable increase of efficiency in the interrogation and obtaining of data in the processing systems and as regards the quality and quantity of the data offered for utilization;

— the multiple facilities provided for an organic integration of the data electronic processing technique into the current management and execution activity, directly contributing to improving the quality of these activities and at the same time, leading to the creation of the interactive man-machine systems, to the cybernetization of these activities;

— the considerable reduction of the effort of analysis, especially of that of programming, as a result of the possibilities given in the use of standard procedures and programmes whose share may exceed 50—60 per cent of the total time required by the analysis and programming activities;

— the contribution to the achievement of information and respectively integrated informatic systems by reducing up to elimination of the redundant information and consequently ensuring a minimum cost of the processed data, inclusively by sensibly raising the degree of intensive data processing (this advantage is also expressed by the possibilities of concentrating the data in a certain field of activity), by a greater specialization of the information systems, sparing for most of the users the efforts necessary for the collection, transmission, verifying, processing and up-dating of data; (these users becoming permanent or occasional subscribers to the data banks as well as in the case of the services provided by the telephone, electric power enterprises and by libraries);

— the technical and functional compatibility with the requirements for the organization of informatics, territorially distributed, for the organization and use of the integrated network of electronic computers; in fact, the data banks represent one of the main elements in the fulfilment of these desiderata, considering that the computer networks are the technical-material support for the achievement of the large shared data banks network.

The advantages offered by the data banks are partly due to the technical-scientific achievements obtained in the field of the methods and techniques of data organization, of the programming languages for describing the data and the relations between them, of the control languages to be used by the applicative programmes, of the languages and methods of direct interrogation of the data stored into the electronic processing systems, all this being united into the standard programming systems specific of the data banks, into the administration systems of the banks (of the data bases).

3. TRENDS AND REQUIREMENTS IN THE DEVELOPMENT OF THE DATA BANKS ADMINISTRATION SYSTEMS

The data banks administration systems have added new functions, new facilities to the informatic systems and implicitely to the information systems in comparison with what had offered the electronic processing systems based on the utilization of classical data files and even on large shared files. Thus, in the data banks the organization of data being made at a level of information identity, for example, at the level of an indicator and the relations between these identities imposed by the users' concrete needs being known, a minimum information redundancy in the respective processing system is ensured and the reply time in the conversational work system is brought nearer to the performances of the systems functioning in real time. Another extremely important problem solved by the data banks administration system (SGBD) which has led to a considerable increase of the efficiency of the informatic systems was the possibility of ensuring the interdependence of the application programmes, in comparison with the way of organizing and administering the data, which has been done by detaching from the application programmes the description of data and the connections between them. This facility has led to a considerable reduction of the effort to redesign the applicative programmes, respectively of the programming effort and, at the same time, it has enabled the users' relief of the task of knowing the entire data bank structure,

a task which becames more and more difficult to fulfil because of the constant growth of the complexity of these structures. Thus, they have come to an independent administration of the general structure of data which is called virtual structure or a virtual level of data organization.

In this way, two levels of independence appear: *the logical independence* ensuring the possibility of changing the virtual structure of data without modifying the application programmes and *the physical independence* ensuring the possibility of modifying the physical organization of data without changing the virtual structure of data.

Two main trends have been registered in the development of the data banks administration systems:

a) the achievement of SGBD with a wider sphere of the fields of application (generalized SGBD) destined to take over through the standard programming system part of the programming targets necessary for ensuring a large shared data administration but which still requires a considerable effort of programming for satisfying the users' demands:

b) the achievement of specific SGBD-s for certain types of domains with a lower degree of generalization as application domains but with greater facilities for users and with a larger share of the standard programmes.

The first group also includes the SGBD based on the SOCRATE system of the library of the FELIX electronic computer family to the implementation and development of which the Romanian specialists in informatics have also made an important contribution. The fact that SGBD-SOCRATE is a generalized SGBD has led in the present stage to a wide range of specific variants of application, the difference between these variants being given by the important share of the programmes to be worked out for satisfying the users' specific demands. Thus, the following conclusion can be drawn: the smaller the share of the standard programmes provided by SGBD as compared with the total programmes necessary for the achievement of an informatic system of the data bank type, the greater the number of specific variants grafted on SGBD respctively; and, a great number of specific variants means a great programming effort. That is why the proccupation for increasing the share of the standard programmes provided by SGBD has led to the second trend in the development of SGBD which is characterized by a narrowing of standardization on the horizontal (application domains) in favour of a sensible growth of standardization on the vertical line (as regards the SGBD function directed towards the users). As a significant example for SGBD of this second group, we can give the specific SGBD for applications in the selection, distribution and/or booking of seats or other categories of resources (in air, railway, road or maritime transportation, in polyclinics and hospitals, in hotels, rest or treatment homes, in the distribution and allocation of material resources for production and/or for sales, in the selection by the population of service units, for subscriptions to books, newspapers and reviews, in the selection of the educational units and the distribution of the graduates from these institutions, a.s.o.

As results also from this ennumeration, even a specific SGBD of the type of that exemplified above has a sufficiently wide sphere of application. This

conclusion also suggests the re-analysing of the name of specific SGBD; the name of SGBD specialized for various types of applications would be more adequate, respectively a SGBD oriented towards a group of users whose demands for information have a greater level of homogeneity. Thus, specialized SGBD-s for the informatic systems of the production industrial units or for units, commercial organisations, for the informatic systems of the socio-economic management of the counties or of the departments, ministries, branches, etc. can be worked out.

Considering that, as a rule, the specialized SGBDs contain all the functions of the generalized SGBDs and the working out of such a SGBD requires considerable high skilled forces in the software domain of the order of hundreds of man/year, it is reasonable that specialized SGBDs should represent the developments oriented towards a homogeneous group of users of generalized SGBDs.

The experience gained by the Centre of Informatics and Cybernetics for Planning in the working out and use, for several years now, of a specialized SGBD for the Data Bank of planning grafted on SGBD-SOCRATE reinforces this conclusion. In out opinion, the specialized SGBD for the Data Bank of planning 7 can also be used in the information and respectively informatic systems of the economic departments and ministries, of the counties and of other economic synthesis bodies which reinforces another conclusion mentioned above as regards the possibilities of extending the sphere of users of speciliaized SGBDs.

Considering the great advantages for users of the data banks in the last few years, the number of the information systems based on data banks has increased on a world plane from a few hundreds to several thousands, at the same time, a process of their clustering into specialized networks on types of applications (for the financial-banking systems, for technical-scientific information, for trade unit networks, etc.) being registered. The considerable increase of the users' demand for the organization of new data banks in the contemporary information systems has, at the same time, led to the consolidation of the second trend in the development of SGBD, respectively of specialized SGBDs.

The programme for the development of informatics in our country in the 1981—1985 five-year plan period and in the future envisages a sensible increase of the targets concering the data banks designing, organization and utilization, with an obvious orientation towards data banks specialized on types of applications, respectively on homogeneous groups of users, among which we can mention the population data bank, the public health data bank, the data bank of the Bucharest Municipality and other county data banks, department and branch data banks, etc.

The extension of the use of data banks in the information systems of our country will represent a considerable qualitative leap in raising the efficiency of these systems and implicitely the activity of informatics will represent a stage in which the users' demands will be satisfied to a greater extent, at the same time, being an essential support to an all-level management of the socio-economic activity.

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LE ROLE DES BANQUES DE DONNEES DANS LES SYSTEMES INFORMATIONNELS CONTEMPORAINS

On met en évidence la nécessité d'étendre l'utilisation des banques de données en tant que voie sûre et efficace de grand perfectionnement des systèmes informationnels contemporains et respectivement, de satisfaction dans une plus grande mesure des besoins des utilisateurs. Les banques de données sont présentées, dans le même temps, comme une solution d'un degré adéquat d'intégration des systèmes informationnels, cependant qu'une mise en évidence des tendances de la recherche dans l'élaboration des systèmes de gestion des banques de données.

РОЛЬ БАНКОВ ДАННЫХ В ИНФОРМАЦИОННЫХ СИСТЕМАХ

В работе выявляется необходимость распространения использования банков данных в качестве надёжного и эффективного пути усовершествования современных информационных систем и наивысшего удовлетворения потребностей потребителей. Банки данных представлены одновременно и как способ обеспечения соответственной степени интеграции информационных систем, вместе с выявлением тенденций исследования по разработке систем управления банками данных.