SYSTEMS RESEARCH INSTITUTE,
POLISH ACADEMY OF SCIENCES, SZCZECIN DEPARTMENT
AGRICULTURAL UNIVERSITY OF SZCZECIN
FACULTY OF ECONOMICS AND ORGANIZATION OF FOOD ECONOMY

MODELLING OF ECONOMY IN SPECIALLY PROTECTED REGIONS

Proceedings of the international conference held on 9-11 june 1994 in Drawno, Poland

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DATA BASE SYSTEM IN ADMINISTRATION OF A REGION BY THE USE OF SBD (Dictionary Data Base)

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1. Introduction

The problem of environment protection is the one which cannot be isolated from the objectives of economical activity of a REGION. This problem is included into one of the three groups of objectives, namely: high economical efficiency, humanization of labour processes and care of natural recourses of the Earth. These objectives should be considered at a level of enterprise. Something which brings these purposes together is an efficient management information system. And more precisely, organization and administration of data bases in relation to dynamically changing information needs of various levels of decision making process in the region. From the theoretical point of view it requires such an information system, in which the administrator has an opportunity to get on request the information from many

domains of activity at the same time. It is consistent with the theory of controlling, because on the first hand - the control is performed inside the system, and on the second hand - the system is controlled as the whole, on the assumption of simultaneous access to the whole and the detail during the decision making problem.

The paper has a methodical character and presents some solutions obtained in the field of building large information systems, in our case - for needs of government administration. The article deals with some connected to one another problems, such as: organization of information systems for high levels of administration, solutions of such systems for structures considered, and the form of exemplary skeletal base for needs of environment protection in the region. It should be stressed that the matter is not exclusively a system for monitoring the state of environment protection itself, but a more general system for assisting decision making process in the region, including - among others - also problems related to environment protection.

2. Organization of information system for regional managing levels

An example of a complex information structure, in which the problems from the field of environment protection occur at the level of department, is the administration structure in the Voivodeship Office. A particular feature of information-decision system of this organization is a strong subordination to the place where the main decisions are made - a VOIVODE cabinet. As a matter of fact, it is not a hierarchic system, but rather a mixed one, in which many both autonomous and common for the

whole OFFICE subsystems occur. The problem is: how to organize (design, programme and implement) an information system for specific domains, so that information needs of particular DEPARTMENTS and their main decisional level VOIVODE CABINET are met. In fact, there are only two opportunities to choose, namely one should:

- aim at building a large, integrated information system, being able to comprise all possible domains of the OFFICE, which seems to be an unrealistic solution - impossible to realize from the viewpoint of technology;
- create a new, of better qualitative features, information system, which would have opportunities of constructing own data bases, as well as making use of information stored in other (autonomous) information systems.

The problems stated above lead to another outlook on the hierarchization of administration information system, mainly to orientation of the system towards the group of people who administer - i.e. are in power.

Specification of EIS (Executive Information System) off the whole information system of a large organization is justified by specific information needs of narrow and competent group of people - chief management. For this group of people it is required that the information system has the following opportunities:

- dynamic creation of internal information by the user himself and an open access for external data;
- central and decentralized storage of data of various types, irrespective of the form of their representation;

- unrestricted generation of information services from various levels of data bases (from both source and already processed data);
- making use of various data presentation forms and possessing functions of communication with other systems;
- integration of data base networks with methods assisting making decisions, for instance with the methods of objectivization in thriftiness investigations, short- and long-term forecasting, optimization and expert systems.

Typical feature of EIS is installation of centrally managed data base, which is operated by a specialized cell of 3-4 people. This cell updates the base and creates new data bases on the basis of various internal and external sources of information; the former is carried out in regular elapses of time or, which is very important, on unexpected orders of the CHIEF MANAGEMENT.

Such a centrally administered data base is, as a rule, accessed simultaneously by several managers (MANAGEMENT). They perform that within the framework of a particular computer network, e.g. popular also in Poland Novell network, and have at their disposal:

- regularly updated reporting (STATE-OF-THE-ART REPORT), according to uniformly accepted convention of topical tabulations;
- elastic inquiry language with changeable contents and degrees of source data aggregation.

The access to the system is carried out in a decentralized way, e.g. through a PC terminal, whose parameters ought to enable

an individual user to create his own data base, access to other DEPARTMENTS, linking data bases, creating new and deleting existing ones, graphical edition of numerical results and, which is the most important, supplying information "ON REQUEST".

3. System of data organization within convention of SBD (Dictionary Data Base)

The problem of integration of information system within the concept of EIS leads to building appropriate data base management system of many, often very advanced features, such as: data integrality, maximum simplification of the computer use, multi-access, protection of data against illegal access, 'seeing' other systems and bases, collaboration with methods of representation and decision solution generation.

The matter is relatively simple as far as we identify a specific information-recording system with one or more bases closely linked by means of software. But in our case we are interested in creating the whole, hierarchized and able to change dynamically, system of bases. The other problem is how to use external bases, written within other notional models, which we want to reach and get to know, or even create our own solutions by applying them. The demand for information may concern source data relating to the state of realization as well as their aggregated state. Our aim is to get information related to our expectations (plan) and satisfying the standards recognized as efficient activity. Since we want to attain it in a single system - and not admitting chaos in information supply - we have to assume some canons in our model of information system. Let us emphasize once more - our aim is to build the model which will enable relatively complete

representation of information system of any object: enterprise, commane or region, and also over-regional units.

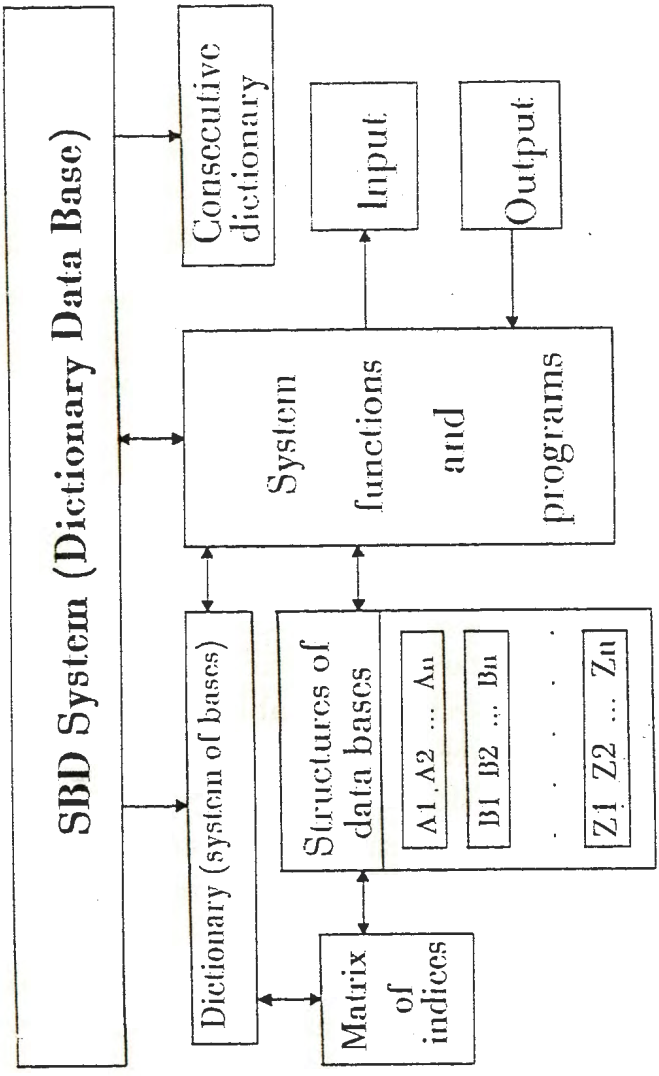

Fig. 1 General model of SBD system (Dictionary Data Base)

An attempt to describe all the above mentioned logical relationships among the system elements by applying the classical approach - based on loosely connected to one another data files (even within relational concept) - fails. In order to describe the problem completely it is necessary to create such a construction of indices in building and controlling the information system, so that the relatively full description of the user information system is possible. The solution applied, based on the quality indices DICTIONARY (a language of system structures description) of the whole information-decision system has been called[1] the SBD (Dictionary Data Base) technology. In the DICTIONARY we have assumed certain typology of structures in the sense of system hierarchization (system - base - field) and certain data organization solutions, where e.g. the level A - represents the structures of source data relations, B - represents data structures relations aggregated and described further at the levels C,..., Z. The structure level $B_i \in (B_1, B_2, ...B_n)$ can be described in the DICTIONARY provided that the suitable base level $A_i \in (A_1, A_2, ...A_n)$ is defined. Similarly, higher levels of aggregation, i.e. $C, D, ..., Z$ must possess correspondingly lower data structures. But no restrictions on aggregates generated from among the same or lower levels have been imposed. One can easily see that the number of structure description levels in the DICTIONARY and the number of connections among them is only a matter of information demand, often being determined dynamically after the system already works (Fig. 1). From the viewpoint of logic, the data model adopted in SBD has a form of flat files, which take into account the following restrictions:

[1] About specialistic software for data bases networks within the concept CASE (Computer Aided Software Engineering) cooperating, among others , with decision assisting mathematical methods, see: R. Budzinski: SBD - a dictionary data base, a tool for assisting the information-decision process of management organization, in: Software products offered by the System Research Institute, Warsaw 1990.

- each file (relation) contains records of only one type;
- each record type has a constant number of attributes (fields);
- each record occurrence has a unique identifier;
- record occurrences arrangement in the file is performed with respect to identifier value, which is stored in a multi- dimensional matrix of indices (keys).

The adopted solution has been based on files and software related to the class .DBF, which is most often applied in relational data bases. It is brought in question (the remark to Anglo-Saxon companies boosting the convention .DBF) whether it is not better to introduce data description indices into a separate, but interdependent DICTIONARY. It would allow, among others, to increase a description range of considered .DBF information system. So far it has been carried out with the help of only 4 indices (name, type, length and dec) assigned to each of the files separately. In our SBD approach we use 16 indices arranged into a certain logical network, which reflects quite well even complex management information systems. The DICTIONARY can be subdivided, its features can be transferred to new structures, and both its parts and the whole system can be linked or modified without reliance on physical data structures. Deletion of logical description of data (DICTIONARY structures memory) is equivalent to the loss of data in a computer

4. Information system model for Voivode and Voivodeship Office Departments

The central point of efficient work of the region is organization of data. Many approaches are applied in order to determine

an optimum of information readiness. Reconnaissance studies of Voivodeship Office information system revealed two layers of this system[2]:

- operational-tactical, which ensures proper work of particular OFFICE DEPARTMENTS;
- strategic, supplying the regional administration authorities (VOIVODE) with information.

The first subsystem ensures normal performance of functions of respective administration units and is based on files containing all information concerning specific domain. The data are identified in both time and spatial domains as RR MM WW PP GGG, where RR - denotes year, MM - month, quarter or half-year, WW - province, PP -region (district), and GGG - commune. The second layer, having often the same identification structure as the first one, has a global character and bases on information concerning the province (region) as the whole. In practice, it is the second layer which - because of the full of its decisional power - makes decisions in the region. So there is a strong reason - need in creating exclusive information system to serve regional administration (VOIVODE). The aim is to build a Polish equivalent of EIS (Executive Information System), being the specific CHIEF MANAGEMENT SYSTEM.

From the information point of view, the CHIEF MANAGEMENT SYSTEM should consist of a series of bases, comprising information from such domains, as: DEMOGRAPHY, EMPLOYMENT, HEALTH PROTECTION and SOCIAL CARE, AGRICULTURE, ENVIRONMENT PROTECTION, TRANSPORT SERVICES, EDUCATION, TOURISM and SPORTS,

[2]The research held by a team of R.Budziński was sponsored by Szczecin Voivode and Scientific Research Committee in Warsaw (contract 280/C.S. 5-8/92).

INVESTMENTS and subject enterprises, carrying out economic activity (Fig. 2.).

At the voivodeship level two types of data bases, covering a given region, would function:

- SBW - a wide, divided according to departments, network of domain bases;
- SNK - a narrow, specialized information service of chief management (VOIVODE), operated by a small, but competent and very efficient group dealing with the data updating.

For each of the specified domains a store of initial information, called the skeletal bases, is defined in the project. It is the information, whose significance for management is studied by the use of scientific methods. It does not mean that earlier defined bases have to be preserved in the same form, as planned in the project. The bases have an open character, i.e. they can be changed, dependent on information needs of a given organization level, and structures once put into the system can be updated individually by the user. In this case application of the SBD technology allows for the use of two information levels: the general and the detail (SNK and SBW) by many users simultaneously. Obviously, each of the DEPARTMENTS of voivodeship level possess its own SBW system. The number of systems working within the framework of the SBD technology equals the number of possible 8 - letter system name combinations. Since each system can contain up to 999 source bases at each of the levels *A* to *Z*, and each base can consist of maximum 999 fields (positions) - the number of systems located in the SBD may be considered as practically unlimited.

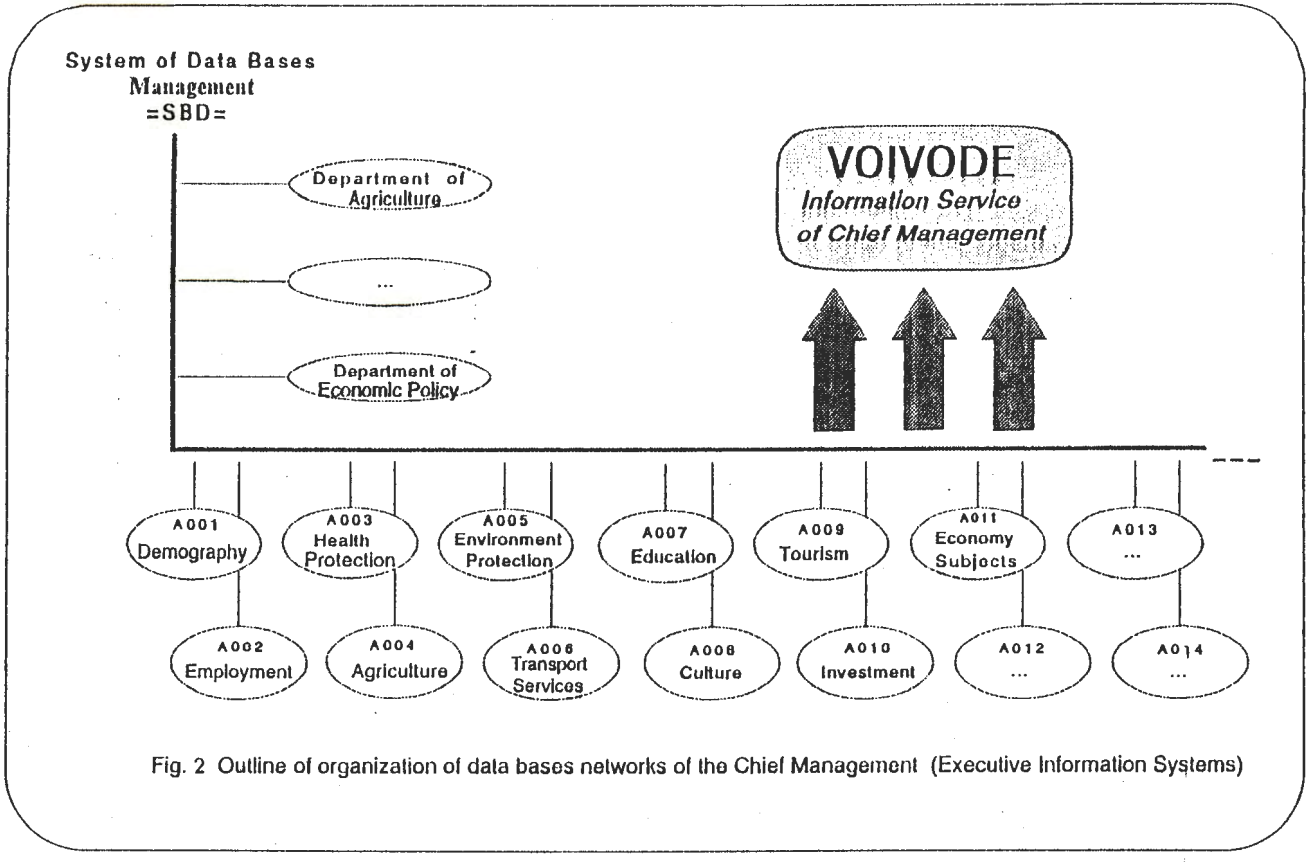

Fig. 2 Outline of organization of data bases networks of the Chief Management (Executive Information Systems)

5. An attempt of efficiency evaluation of applied system and problems related to its practical implementation

The efficiency of a system implemented into practice may be understood in some ways. On the first hand, it may be considered as economical efficiency evaluated by comparing buying costs of corresponding systems of economical analyses, offered most often by foreign suppliers. On the other hand, the efficiency may be understood as methodical quality of applied Polish solutions, namely:

- an opportunity of reflection of the whole real, multi-level and spatially-hierarchic information-decision network of the user;
- efficient, user-friendly interaction language and opportunities of easy manipulating data bases;
- opportunities of simple designing of new bases and edition of various graphical interpretations.

The SBD system is provided with built-in modules enabling: economical efficiency analysis, forecasting, carrying out poll investigations and multi-criterial optimization. These modules can be used directly and simultaneously with compiling source data.

To conclude with it should be emphasized that the efficiency of applied - in our case very complex - information system depends on training of employees of a given institution, and first of all the decision-makers themselves (even VOIVODES), in proper use of computer technology in management process.

Table 1. Exemplary skeletal base for the Environment Protection Department of the Voivodeship Office

	Specification	Updating	Importance of information			Confidentiality	Type of imp.	Length		Units of measure	Headline
			Li. A	i. B	v.i. C			char.	dec.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
1	Identifier						C	11	0		RECORD IDENTIFIER RRMMWWPR GGG
2	Period (month, quarter, half-year)						K	2	2	KOD	PERIOD 01.....12 K1.....K4 P1.....P2
3	Province						K	2	14	KOD	PROVINCE
4	Region (district)						K	2	14	KOD	REGION
5	Parish						K	3	14	KOD	PARISH
6	Water production quantity of municipal surface intakes	R		x			N	9	0	m^3	WATER FROM surface municipal intakes
7	Water production quantity of municipal underground intakes	R		x			N	9	0	m^3	WATER FROM underground municipal intakes
8	Water production quantity of industrial surface intakes	R		x			N	9	0	m^3	WATER FROM surface industrial intakes
9	Water production quantity of industrial deep-water intakes	R		x			N	9	0	m^3	WATER FROM underground industrial intakes
10	Number of municipal sewage treatment plants refined mechanically	R		x			N	4	0	item	N.of mun. sewage t. plants
11	Quantity of municipal sewages refined mechanically	R		x			N	9	0	m^3	Municipal SEWAGES refined mechanically
12	Quantity of municipal sewages refined mechanically biologically	R		x			N	9	0	m^3	Municipal SEWAGES refined mech.-biol.
13	Number of industrial sewage treatment plants	R		x			N	4	0	item	N.of ind. sewage t. plants

14	Quantity of industrial sewages refined mechanically	R		x			N	9	0	m^3	Industrial SEWAGES refined mechanically
15	Quantity of industrial sewages refined mechanically biologically	R		x			N	9	0	m^3	Industrial SEWAGES refined mech.-biol.
16	Number of mechanical-biological-chemical sewage treatment plants	R		x			N	4	0	item	N.of mech. biol.&chem plants
17	Quantity of crude sewages	R		x			N	9	0	m^3	CRUDE sewages
18	Air dusty pollution	R		x			N	9	0	kg.	AIR DUSTY pollution
19	Air gaseous pollution	R		x			N	9	0	kg.	AIR GASEOUS pollution
20	Sulfur dioxide air pollution	R		x			N	9	0	kg.	AIR pollution with SO_2
21	Industrial wastes arduous for environment (stored)	R		x			N	9	0	Mg	INDUSTRIAL wastes arduous for environment
22	Portected areas and objects	R		x			N	4	0	item	PROTEC TED objects
23	Charges for air pollution	R		x			N	9	0	zl.	CHARGES FOR air pollution
24	Charges for sewage disposal	R		x			N	9	0	zl.	CHARGES FOR sewage disposal
25	Charges for water uptake	R		x			N	9	0	zl.	CHARGES FOR water uptake
26	Charges for waste storage	R		x			N	9	0	zl.	CHARGES FOR waste storage

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