THE NEED FOR A UNIVERSAL CATALOGUE

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ABSTRACT

This article discusses the need for a universal catalogue; illustrates its applicability in various organizations, and shows how an organization can effectively adapt to its purposes in spite of seemingly large differences among the various catalogues that deal with various subjects in different organizations. The purpose of this study is to bestow upon the catalogue the status it should have in the eyes of the systems analysts, system designers and management.

The conclusion reached in this work is that the parametric concept of a universal catalogue proves itself as a more reliable and efficient approach than the one preaching individual solutions for every particular organization.

INTRODUCTION

This article concentrates on the strategic data bases of the organization; their central position and their function in the management information system of the organization; their general structure; and the methods that insure their design. This study shows that the structural principles of the "catalogue" are independent of its type, of the items it manages and the organization it serves, and that these are common to all catalogues. The

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universal definition and structure of the "catalogue" concept and a method of application for any organization are given here as a basis for the formulation of this thesis and its demonstration.

The catalogue, which is part of the data base in any organization, plays a central role in any activity (computerized or manual) depending upon organizational data bases. The maintenance of the catalogue and its development should be regarded as a prestigious task in the organization. Actually, the situation is different. Organizations are not generally aware of the importance of catalogue maintenance and do not pay much attention to the principles of catalogue building. As a result, the organization causes itself managerial impairments which will be illustrated in this work, and which can be avoided.

This article discusses the need for a universal catalogue; illustrates its applicability in various organizations; and shows how an organization can effectively adapt it to its purposes in spite of seemingly large differences among the various catalogues that deal with various subjects in different organizations. The purpose of this study is to bestow upon the catalogue the status it should have in the eyes of the systems analysts, system designers and management.

Possible Applications

The professional literature profusely mentions organizations that are in need of a catalogue applicable to their area of activity. This article covers the sources dealing with the various types of catalogues, and the solutions suggested for them in each case. Here are some examples of organizations in need of a catalogue (in some cases the organization recognizes that the information it needs corresponds to the definition of a "catalogue", whereas others lack a data base definable as a "catalogue" despite the need for it):
— Production, development and maintenance enterprises
   — in need of an items catalogue (*Federal Catalog System*,
     1982).
— Personnel management departments — in need of a
catalogue of employees and professions.
— Educational institutions — in need of a curricular cata-
logue and a catalogue of teaching aids.
— Matrimonial offices — in need of a client catalogue.

This article deals with various problems that can be solved
by the adoption of the universal model, such as:

— The unification of various and partially overlapping
catalogues, according to managerial needs. This problem
is presented by Tobolka who dealt with the need of
unifying all art exhibition catalogues under one system
of classification.
— Complex retrievals in a fast and easy fashion.
— Communications problems with other institutions, which
   can be avoided by the creation a common “catalogue”
   language which ensures a dialogue between organizations.
   This question is frequently mentioned in the literature
   and seems to be a main cause for concern. Kopcsev
   presents the problem of the lack of communication
   between catalogues dealing with the same subject and
   proposes the foundation of a bank of publications cata-
   logues. Tobolka analyzes the problems caused by the
   lack of uniformity in cataloguing standards and the
   ensuing difficulties in communicating with other organi-
   zations, and proposes uniform, international catalogue
   standards. The creation of various standard books cata-
   logues (such as the Dewey Decimal Classification System)
   attests to the fact that certain organizations have recog-
nized the need for uniformity in cataloguing methods. In fact, as far as books are concerned, there already are international catalogue standards.

- The application of "off the shelf" software packages designed to ensure the development and maintenance of the organization's catalogue.
- Transformation of "catalogue science" from a field reserved for a few pundits in the organization to a simple task accessible to all.

**Literature Survey**

Many sources use the term "catalogue" to designate a tool intended for the storage of a certain type of data, such as: items catalogue of the U.S. Army, scientific publications catalogue, entities catalogue, patents catalogue, and many others that will be mentioned in this work.

The attitude of the existing literature towards the catalogue is not one that grants it merit as the central data base of an organization. Nor does any source make any allusion whatsoever to the effect that all catalogues (eventually) serve the same purpose, and that it might be possible they have common structural characteristics.

Many articles, which are mentioned in this work, are about problems pertaining to inter-organizational communications and ensuing from the fact that the objects of communication are not catalogued in the same "language". Kopcsev explains the problem in the context of publications catalogues, and Tobolka keenly undertakes the task of proposing an international solution of standardizing the process.

A number of articles point to similarities and connections between catalogues. This is done only as far as catalogues having the same subject matter are concerned. None of the articles surveyed have indicated any similarities among all catalogues
(catalogues of different subject items).

Support for the thesis presented in this study is found in Aristotle's work *Encyclopedia of Philosophy*, 1967, which deals with the question of partition and categorization.

WHAT IS A CATALOGUE?

Traditional Definitions

Catalogues are familiar in a wide range of fields: libraries, commercial and industrial enterprises, educational institutions, museums, etc. The traditional catalogue with which we are familiar is generally a thick book, sorted according to a certain method and including basic information on a long list of items of the same category. The computerized catalogue is a serialized set of files or indices containing the information in an easy-to-store-and-retrieve medium.

Renowned dictionaries define "catalogue" as follows: *Webster's New Twentieth Century Dictionary*: "A list or enumeration of names, titles, articles, etc. arranged in a certain order, often alphabetically, as, a catalogue of books, of merchandise, etc." *Encyclopedia Britannica*: "Cataloguing; Basic to the organization of any library alphabetically by author, subject and title, providing a description of each item and identifying it from all others, usually by a notation consisting of combination of names and letters."

The uses of the catalogue depend upon its type, but generally it serves as an aid to the internal and external management of the items it contains. The main information traditionally stored in a catalogue is an inventory list of the items handled by the organi-
zation and some characterizing data, such as:

- A books catalogue lists the various books available in a library, the author's name, year of publication, the publisher, etc.
- A vendor catalogue lists the items on sale, prices, item descriptions, delivery terms, etc.

In its traditional use the term "catalogue" can be defined, then, as a *set of pertinent data in a relevant context*. The traditional concept guiding an organization and its managers is that the catalogue is not a central data base substantiating the general information system of the organization as a whole. This way of thought is apparent when one observes the number and qualifications of personnel in charge of maintaining the catalogue, and securing the information level, and in many other elements pointing to the catalogue's disparaged status in the organization.

In addition to these concepts, many other sources use the term "catalogue" as the collection of specific data on a set of items. We shall later detail these sources. For example: stars catalogue, publications catalogue, geological maps catalogue, and the U.S. Army items catalogue.

A point common to all of the sources already mentioned and to others that will be referred to, was the fact that the organizations were required to store data on a set of items of the same category, and that every one of them solved the problem on an individual basis, defining their own storage standards. *The organizations called this arrangement of information of items of the same kind, a "catalogue".*

**This Study's Definition of "Catalogue"**

In every managerial mechanism there is a number of managed objects that form the managed world. In an industrial establish-
ment these are the machines, the raw materials, the personnel, the orders, etc. In a library these are the readers, the books, the shelves, the publishers, etc. And in a university the managed objects are the classrooms, the courses, the staff of lecturers, the students, the office equipment, etc.

The concepts representing these objects will be called *entities of the organization*. An entity is formed by copies of elements attributable to it. Every entity can represent a population of zero, one or many copies. Some of the characteristics of the copies are dynamic and not essential: the location of a book, the orderliness of a certain machine, the subject matter of the lecture given at this moment in any classroom, and so on. They characterize a specific copy and not the entity. The organization can control these by using the dynamic data bases which are easy to update.

Another characteristic of a copy, and an important one, is its *significance*. This actually characterizes the entity from which it is derived: the number of pages in a book, the average electricity consumption of a machine, the number of seats in a classroom. These are all significant characteristics of various entities, and by which they are sorted, depending on the needs of the organization. Significant characteristics cannot be easily changed and the mode of their distribution can cause the organization to require a large number of entities instead of numerous copies of one entity. These characteristics that the organization is expected to manage for information handling purposes should be managed in static data bases. The updating of such data bases requires a high degree of professional expertise, errors could be too expensive to make.

In this article "catalogue" will be defined as: A data base **featuring the significant characteristics of the entities managed in an organization**.

It is clear, then, that this article broadens the scope of the *catalogue* concept to embody elements not included in the traditional definitions, examples of which will be mentioned later (such as a personalities catalogue of a public relations enterprise). If
we succeed to clarify the basic difference between the static and
dynamic data bases, to show the essential and uniform structure
of the static data bases independent of the managed entity, and
to analyze the importance of the duly-handled static data bases,
then the broader approach to the concept of "catalogue" will be
justified.

The Users of a Catalogue in an Organization

A catalogue in an organization, as defined previously, has
various types of users. The purpose of this work is to show that
it is possible to build a catalogue for anyone of these users
according to their field of activity. Such a tool is generally derived
from a larger catalogue and is more easily handled. For instance,
the users of an items catalogue in a large engineering organization
are:

- Logistics personnel — identification of the items for
  storage, issuance, purchase, etc.
- The engineers — choice of items for development and
  maintenance.
- Operations personnel — choice of items/tools for the im-
  plementation of tasks.

A report published by the U.S. Army which deals with the
items catalogue in use shows clearly that these are indeed the
definitions given to "catalogue" by its users (Federal Catalog
System, 1982)

Different users have different perceptions of the same cata-
logue depending upon their field of interest. Purchasing people
are interested in certain characteristics which are not of interest
to storage personnel, even if these are attributes of one and the
same item. As a consequence, each and every derivative of the
catalogue will be designed to suit the needs of different users.
Each and every one of the data bases that will be described
in this article has a definite purpose in the organization and its
own specific users. Descriptions of such data bases will be given in this study in connection with its characteristic users and applications.

The Catalogue and Other Data Bases in the Organization

We have already made a distinction between static data bases and dynamic ones, but no distinction has been made as to their being computerized or not. The static data bases — the catalogues of the organization — contain static information on the entities managed by the organization. This type of information does not change frequently, and modifications to it are generally due to policy changes, expansion of the organization, or other such "strategic" changes. On the other hand, dynamic data bases contain information that is characterized by relatively frequent changes. This is the kind of information that keeps track of the current activities and transactions of the organization.

If, in as far as data bases are concerned, we assume that,

\[
\text{level of activity} = \frac{\text{number of records retrieved in a work day}}{\text{total number of records in the file}}
\]

\[
\text{dynamic level} = \frac{\text{number of records updated/created in a work day}}{\text{total number of records in the file}}
\]

then we can then determine that catalogue data bases are characterized by a high level of activity and a low level of dynamism. The activity level of dynamic data bases, which are characterized by high dynamism, will then depend on the specific application. Table 1 exhibits the differences between dynamic data bases and static ones.
Table 1: The main differences between dynamic and static data bases

<table>
<thead>
<tr>
<th></th>
<th>STATIC DATA BASES</th>
<th>DYNAMIC DATA BASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data type</td>
<td>strategic data</td>
<td>tactical data</td>
</tr>
<tr>
<td>Characteristics</td>
<td>constant</td>
<td>status</td>
</tr>
<tr>
<td>Update accessibility</td>
<td>by experts; no accessibility to most users</td>
<td>update operations by most users in the course of transactions</td>
</tr>
<tr>
<td>Type of update</td>
<td>catalogue modifications</td>
<td>transaction</td>
</tr>
<tr>
<td>Data security purpose</td>
<td>ensuring commercial confidentiality</td>
<td>ensuring against forgeries of data, such as fraud</td>
</tr>
<tr>
<td>Origin of updates</td>
<td>prof, literature, tech, innovations, development of professional environment, policy changes etc.</td>
<td>current activity in the organization</td>
</tr>
<tr>
<td>Main reasons of data base size</td>
<td>development pace, professional diversity</td>
<td>the size of the organization, early start</td>
</tr>
<tr>
<td>Update frequency</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>Example</td>
<td>electricity consumption of a machine, classroom capacity, etc.</td>
<td>the task performed by the machine now, the number of students sitting in the classroom now, etc.</td>
</tr>
</tbody>
</table>
Existence of Groups in a Catalogue

The relations among various entities of the same kind in an organization suggest different levels of classification. In this section we will review certain types of classification suggested by the logical architecture of a catalogue.

On the basic level, there are a number of entities that could be considered as identical in some aspects, and widely different in others. Two 7/8"x8 cm. screws coming from two different manufacturers might be considered as identical, as far as the technician who uses them is concerned; but the purchase manager will obviously see them as two very different items.

There is, consequently, a need to classify entities according to some partial interchangeability.

On the other hand, there are some entities in an organization that are be interchangeable, but still have many common aspects. A 7/8"x8 cm. screw cannot be replaced by a 5/16"x6 cm. one, but they are both screws and could possibly be used by the same person in the organization. It might very well be that they have even more in common.

There is, consequently, a need to classify entities by types.

As an accepted policy of the organization, or as a result of interorganizational mergers that occurred in the past, departments in large organizations might be autonomous in building and managing their own independent catalogues. All the entities in this independent corpus have to "live" in an environment of consistency as to the nomenclature and all other informational elements.

There is, consequently, a need to classify entities according to definable considerations.
Therefore, a catalogue has to obviously be something more than a simple sequential classification of definitions or a list of names. In other words, the catalogue is not a dictionary of terms designed to give the meaning of a set of words. We are entitled to expect a catalogue to support various classifications of entities. At this stage it becomes clear that a catalogue must have some intrinsic logic.

The definition of this system of logic and the demonstration that it is common to all data bases in a catalogue as defined here, are the main purposes of the present work.

The Catalogue as a Multi-level Hierarchic Structure

In addition we may say that a catalogue has a definite hierarchic structure connecting its sets of entities, and every level imposes some rules on its "offspring". Every level in this hierarchic structure provides its successors with some new information that was not supplied by the preceding one.

The hierarchy of the data structure in a catalogue finds expression in terms such as:

- **it contains:** An entity contains other entities (a bill of materials, a partial substitute possessing the characteristic of the substituted and some additional one etc.)

- **it is a constituent:** An entity is a constituent of another entity (the reverse case).

- **belongs to:** An entity is part of a distinctive set of entities (all screws, all authors, all resistances, all personalities etc.).
DEMONSTRATION OF THE ESSENTIAL ROLE OF A CATALOGUE

In this section we will try to demonstrate the argument that "the catalogue is the nerve center of the data systems in an organization". In an organization making use of a data base, managerial applications draw principally upon catalogues and the static data stored in them. The following discussion will illustrate some managerial applications in various organizations, and will provide examples of various catalogues they use.

Almost every operation in the organization necessitates the use of static data. From the moment that the organization performs more than one operation or inquiry, and produces more than one report etc., there is a need to know the characteristics of the operation in order to adequately perform it. This kind of information is to be found in the static data bases, that is, the catalogue.

Here are some examples of operations assisted, consciously or not, by static data:

- validity and reasonability check of a transaction;
- providing the user with auxiliary data in the course of current activity — exhibition of relevant catalogue records during the implementation of an activity;
- proposing different alternatives — making choices under operational constraints (retrieval of catalogue information);
- search for the exceptions — retrieval of tactical data exceeding the limits of the catalogue definition;
- policy decision-making — deciding whether to add a new entity to a catalogue or not, taking all the consequences of such an operation into account;

and many other needs that will be reviewed and illustrated in this work.
The Role of a Catalogue in the Managerial Data Base of the Organization

Now that the definition of a catalogue has been made and its prominent role in an organization clarified, we proceed to the explanation of its role in the managerial data base of the organization. The meaning of a "catalogue" includes the management of the essential characteristics of the entities in an organization. Figure 1 shows the location of the static information modules in the general framework of the managerial data bases.

Figure 1: The location of the catalogue in the organizational structure
Figure 1 emphasizes the prominence of the static data bases in the framework of the managerial information system. All other modules of the system draw the information they need from this "center". If at this stage of the analysis we did not make any differentiation between computerized and manual management systems, it is because there is no difference at all. The facts, as presented, are valid even if the data base exists only in the memory of the manager. The profitability of computerization of the system will be examined at the end of this study following the presentation of a model of the universal catalogue. In the following sections we will give some examples of organizations utilizing various kinds of catalogues, in order to illustrate the meaning of the term "catalogue" as it is defined here; the nature of the entity managed by it; its essential role and functions in the organization; and the typical users of various applications. The method by which the examples will be given follows this order:

- Typical organizations
- Nature of the illustrated catalogue
- The managed entity
- Typical users in an organization
- Typical approaches to the catalogue

Some of the catalogues treated as illustrations in this work in general, and in the following sections in particular, should not be taken as existing catalogues or as a sign of their feasibility, but as tools organizations need for the implementation of their operations.

In each example, we shall differentiate between applications that use the catalogue as an operational tool and applications in which the catalogue is not the principal information source but only one of the data bases. In other words, we shall distinguish between the approach to a catalogue as a static data base and the approach as a dynamic data base.
The Catalogue in Engineering Companies — Items

Typical Organizations: Engineering and manufacturing organizations specializing in development, production and maintenance, need detailed information on varied items of equipment used in the organization and available on market.

Nature of Catalogue: Items catalogue embraces information on items of equipment (spare parts or tools). This information may include descriptive data, purchase price and basic characteristics:

Typical Users: Logistics people (warehouse, purchasing, issuing, transportation) engineers and technicians, operators and field workers, etc.

Typical Approaches:

— To whom does the manufacturer sell 4 cm. long 5 Ohm resistors? The information includes static data only and the answer will be found in the catalogue.
— How many types of screws does the organization use?
— static data.
— Where in the organization are more than 50 screws of a certain type stored? — static data.
— The machine bearing the serial number 8294321 is transferred from department 9 to department 4 — the check is made using static and dynamic data; dynamic data is updated.
— Do we have (in the organization) a connector compatible with connector number 72038667? The static data base will give the serial number of the requested connector, provided that it exists in the catalogue. The dynamic data base will provide its location in the inventory.
— Preparation of a purchase order to 20 contractors having the manufacturer reference number LMS54P — retrieval
of static data and update of dynamic data.
- Which type of control cable known to the organization can be connected to connector number 3294726? as in the preceding example.

It should be noted that an items catalogue may serve in other interpretations as a managerial tool for: people, cars etc.

Library Catalogues — books, video-cassettes, records.

Typical Organizations: Libraries of various kinds (public, video-cassette borrowing, study libraries, etc).

Nature of Catalogue: Book catalogue, cassette catalogue that includes descriptive information (characteristics, relation to an organization, publisher etc).

Typical Users: Librarians (to locate, perform borrowing operations, purchase), borrowers, curriculum planners (to design book configurations for various courses).

Typical Approaches:
- Who are the publishers that published the work of Israel Borovits? — static data.
- How many copies of Israel Borovits' "Management of Computer Operations" book do we have? — dynamic and static data.
- What are the books published by Prentice-Hall, Inc. between 1940-1960? — static data.
- Reader 6735 borrowed a book from row 2 in shelf 41 whose catalogue number is 348593 — static and dynamic data.
- I want to borrow Hebrew books from the literature section that are not longer than 200 pages each and do not weigh more than 10 kilograms all together, for a period of two
weeks (is it allowed?) — static and dynamic data.
— Which books are now registered under the reader Israel Borovits’ name, whose number is 1234567? — static and dynamic data.

This catalogue is, then, similar in its form and the nature of the information it manages to the one in the previous example.

Catalogue of People (Public Relations, Agents, etc.)

Typical Organizations: Organizations that currently deal with people and need to retain relevant information on them.

Nature of Catalogue: Catalogue of people the organization deals with.

The Administered Entity: Various types of people, suppliers, employees, buyers, managers of the organizations or other institutions, government officials or civil servants, artists, sportsmen, etc. The organization needs to retain dependable, up-to-date information on these people.

Typical Users: Policy makers of organizations that are in touch with these people, such as sales promoters, personnel managers, marketing and advertisement managers, industrial intelligence people, social activities coordinators, sports teams managers, etc.

Typical Approaches:
— Who are the suppliers of red carpets in the Los Angeles area, that work after 7 p.m. and are classified as “experts”? — static and dynamic data.
— Which brand of wine does the buyer of organization X prefer at dinners? — static data
— 400 dollars should be paid to supplier 3212502 (static data — the address of the supplier).
— Who are the buyers in the classified ads who underper-
formed in the last month?
— A report should be prepared on the last month’s results of activities pertaining to the promotion of the organization’s interests in government ministries — static and dynamic data.
— Who are the organization’s employees living in the Los Angeles area who specialize in financial systems analysis, who are over the age of 60 and classified as “dependable”, who have worked in our organization more than 20 years and are available these days? — static and dynamic data.
— Who are the college basketball players, over 2m. in height, aged 19 to 22, and who can be acquired for less than 50 thousand dollars for the next season? — static and dynamic data.

Information Services Catalogue (Yellow Pages) — Data Items

Typical Organization: The organization that builds the catalogue and supplies the information; the buyers of the product.

Nature of Catalogue: Catalogue of data items intended for the supply of information services.

Managed Entity: Data items; the characteristics of the items are function of their own content and categories. Their update level and level of accessibility through the retrieval fields is previously defined.

Typical Users: The builders of the catalogue and personnel responsible for its updating, the users of the information (anybody), and subscribers to the service who use the guide in order to identify potential competitors and design special marketing policies.
Typical Approaches

— Which sea food restaurants are open in Claremont between 2 and 4 pm and accept credit cards?
— Which Volkswagen garages in Claremont perform overhauls in three days with a 2-year warranty?
— I am shopping for 200-dollars-a-day per couple vacations of one week with full pension in a 4-star hotel that has a nearby tennis court (2 miles at most).
— What are the hospitals specializing in eyes diseases within a 5-mile radius of a given address?

Therefore, by its very definition, this catalogue is both a static and dynamic data base.

"CATALOGUAL" PROBLEMS IN ENTITY MANAGEMENT

Previously we dealt with the role and importance of a catalogue in an organization. Since it is clear that, computerized or not, an organization has to manage its entities, we will try, in this section, to illustrate the typical problems currently encountered by the organization regarding this matter. We suggest to call these problems "catalogual" since they are closely connected to the organization’s conceptual approach to the catalogue, and arise as a consequence of its approach. The problems can be divided into two main categories:

Classification Problems: questions arising from the classification process and the quality of the input data, and pertaining mainly to the addition of new items or the updating of existing ones.

Retrieval Problems: problems pertaining to the use of the information the organization wishes to find in the catalogue.
The problems to be presented are of these two types but, as we shall later explain, there is a mutual influence between the two. Issues arising from the process of classification indirectly affect retrieval problems.

"Catalogual" Problems (Redundancy, Reliability, Expertise, Updating)

The main problems in adding a new "member" to a catalogue are:

_Identification and Redundancy_: Identification is an activity geared to the location of the catalogue entity of a given copy. It consists of defining the new member and attempting to match it to an existing entity (physical or logical identification depending on the examined entity), in order to definitely determine that this new member does not already exist in the catalogue. The main "catalogual" problem in this process, which partly arises from retrieval problems we shall later discuss, is the occurrence of redundancy. Indeed, redundancy occurs when two identical copies are classified under different entities. For example, we can mention multiple entries for identical equipment items that result in double inventory management, identical book catalogues under different classification keys, etc. This problem is extensively analyzed in the existing literature that deals with problems of inventory management, and the difficulties arising from errors in equipment items identification which are connected to the lack of reliable catalogue data.

_Reliability_: Current classification processes are plagued by severe problems of data reliability stemming from the difficulty of avoiding uncontrolled "noise" in data filing. By "noise" we mean incorrect or invalid data (e.g. age = 500), inconsistencies in data definition (e.g. secondary education = none, profession = engineer), etc. This problem originates from a lack of awareness,
readiness to change or the lack of adequate information, and/or a clear-cut verification procedures. The existence of incorrect information makes the catalogue unreliable and the consequence is a tendency to discontinue its use or its update, which in turn enhances its unreliability and causes its constant deterioration.

Expertise: Most organizations perceive classification as a task requiring many years of experience, and as an absolute one-man job. The situation being thus, a large part of the information in an organization accumulates in the memory of one person or a limited number of experts. The catalogue is not accessible to the personnel-at-large, who are dependent upon a "chief-cataloger". The chief cataloger's expertise makes it difficult to replace him/her. It can be done only at the cost of loss of accumulated information (sometimes over many years) that exists only in his or her memory.

Update Level: Modifications in a catalogue containing the static data of an organization come as a result of activities documented in transactions that are classified by a control system. These modifications signify changes of strategy in the organization or elsewhere. It is mandatory to maintain a continual process of updating in order to avoid the above-mentioned deterioration.

Retrieval Problems

This type of problem is not connected to the building of the database but to the level of retrievability and access to data. This is also obviously dependent upon the manner in which the database has been created.

Lack of Data: In most of the organizations which were studied in the course of this research the need for a catalogue was not defined at all, or its essentiality was not understood. A lack of tools needed to accumulate the information indispensable for
the current activities was detected. As a result, the organization was deprived of information on the basic characteristics of the entities it managed. The consequence was the inability to answer questions on some types of catalogues. The lack of data inhibits retrievals according to characteristics identification explained earlier, detection of errors etc. The organization is not generally aware of these problems until it actually needs information that has not been properly recorded.

*Lack of Entity Interrelation:* The lack of awareness and updating procedures triggers a set of issues connected to the ability (or inability) to retrieve and exploit information on the basis of the interrelationship between the various entities (of the same or different types) in the organization. The result is:

- The inability to find a copy that can replace another copy related to the same entity and having the same characteristics of the copy to be replaced.
- Lack of advanced information on similar but not interchangeable entities, such as entities possessing an external characteristic that might cause identification errors; equipment items of one company that could be connected to equipment items of another; etc.
- Lack of information on mutual relations among various entities managed in the organization such as bill of material, organizational ownership, common subject, etc.

All of these problems frequently hinder the activities of the organization. The most serious fact in all of this is the unawareness of the organization to the very existence of these problems. Under such conditions the organization continues its current activity without a general picture of the situation which could have reduced expenses and increased efficiency and production with smaller investments and in a shorter time.
THE UNIVERSAL CATALOGUE

Presented in this section are a solution to the problems that have been discussed thus far, the thesis of this work, and the justification for the development of a “universal catalogue”.

The Justification of a Universal Catalogue

Before we start the analysis of the characteristics of a universal catalogue, the development of a general model that will fit various types of catalogues should be justified. We have already mentioned the fact that the managerial information in an organization consists of strategic and tactical data, or in other terms, dynamic and static data. The main difference between the two is that tactical data is largely dynamic and is fed by many sources, whereas strategic data is characterized by a low level of dynamism, and is maintained by a limited number of people in the organization who are experts in this field. Because of this difference, the information system in the organization will store them in files of different types having different reaction times and requiring different data security systems.

This thesis claims that all of the static data in the organization can be managed in one standard file, called the universal catalogue. Such an undertaking is justified by the very fact that it has the potential of creating a multi-purpose tool possessing many advantages:

A Logical management system: One of the following two methods can be adopted in building a data system:

- A confederation of sub-systems in which it is possible to find a solution to every problem, and to create a problem-tailored sub-section capable of solving the problem in its own terms. Following the creation of such sub-sections
all modules should be integrated under one roof.
- The development of a logical model on which all of the processes connected to the information system are dependent; and the creation of a system which fits the model.

Each of these methods has its advantages and disadvantages and the whole question may be the subject of a separate research project. But in the case of the universal catalogue, as soon as the logical model and a uniform management method for all catalogues are designed, we shall see that the second alternative has more advantages than disadvantages.

**Similarity in definition:** Since the catalogue, as defined here, serves as a tool for entity management, it could be assumed that tools for the management of static data on entities in an organization will be similar to one another, and independent of the managed entity. As we study the above-mentioned examples and the requirements for a catalogue, we will see that catalogues are largely similar. It would be unreasonable to suppose that this similarity is incidental. Thanks to this similarity it is possible to develop a general model and adapt it, in a relatively easy fashion, to any organization or application. This similarity is not analogous, for instance, to that existing among financial management systems in various organizations where the requirements in one organization are different from the ones in others. The catalogue is indeed a tool intended for the management of entities and there is no difference among organizations as far as this kind of management is concerned (in the sense of static rather than dynamic data).

**Software packages:** The development of the universal catalogue will enable the organization to acquire off-the-shelf software packages for the administration of such a catalogue. This
will accelerate the process of development and maintenance of the system, and incur smaller investments.

**Easy maintenance:** One of the most important advantages of the logical model as compared to the sub-sections confederation method is that if the model indeed fits all the applications (the entities in our case), then the maintenance and the supporting software costs are infinitely lower than those of the sub-section system. Any conceptual (strategic) change in the policy of the organization and in its approaches to various subjects will affect only one module, and through it the whole system. There will be no need to invest in changing every module separately.

**Easy communications (inter/intra-organizational):** Since a multitude of relationships of different types exist among sister organizations of a similar concern, or organizations that are members of different concerns, there also exists a great deal of interaction between the entities (of the same or different types) managed by them. If every organization manages its entities according to its own particular concepts and methods, it will be impossible to maintain adequate business and management relations between them. This problem is not particularly characteristic of the catalogue and pertains to all kinds of managerial data. But in this case it is enhanced, since the static data on entities which is not dependent upon the managing organization has to be managed in an identical fashion in all organizations.

Another justification for the development of the universal catalogue can be found in the existing literature reflected in the fact that a large number of researchers have reached the same conclusion that there is a need for such a catalogue. But whenever an organization confronts a problem, it chooses to solve it specifically, and does not attempt to reach a general solution. For instance:
— Schlesinger deals with the communications problem among several study centers using computerized aids. The author presents a solution by creating a uniform catalogue that will be built according to pre-established characteristics, and that will enable data interchange and “conversation” in the same “language”.

— Allan establishes standards for an items catalogue.

— Kopcsev emphasizes the need for a central and homogeneous data base that will concentrate all catalogue data pertaining to periodicals.

— Tobolka proposes an international method of book classification.

It should be stressed that none of them suggested the possibility of building a universal catalogue that would enable classification of all types of items. All of the mentioned articles concentrated on the need to establish classification standards for “beings” of the same type (books, items, periodicals, etc.)

We have enumerated a number of reasons justifying the development of the universal model. We shall not broaden the scope of this discussion before convincing the reader of the simplicity and generality of the model.

The Definition of the Universal Catalogue

A catalogue expresses the managerial semantics of the organization and embraces the exact technical definitions of the entities in it. These entities are defined in verbal descriptions and in terms of relevant characteristics, internal relationships and relations with parallel designations of the same entity in other catalogues.

The universal catalogue consists of a single data base and a number of processes. (In computerized systems — a data base and a number of service programs.) The system is capable of organizing the static data of the organization into a catalogue.
The formal structure assures the preservation of its integrity and consistency, and the preservation of the accumulated strategic data by means of easily operated retrieval systems. Apart from the internal services the universal catalogue provides to the organization, it also constitutes a language which is common among various organizations (by means of the automatic translation of entity terms of one organization into another’s). The universal catalogue will automatically merge various catalogues and manage the same entities in the framework of different catalogues (different semantics) within the same organization. The guiding concept of the universal catalogue is that it constitutes a tool to describe the world of entities.

The world of entities in an organization is divided into sub-worlds according to a permanent system of logic, and clear and arbitrary criteria. Various organizations may decide to divide the same world of entities according to different considerations. The present work provides them with the adequate tools to do that.

The division of the entity world may be illustrated in the diagrams of Figure 2 which are intended to provide a preliminary view on the functional division of the universal catalogue. Further details will be presented in subsequent sections. The passage from one division method to another was performed in this study on a single unit of division.

An example of such a division for the world of technical items may be:

(A) What are the items of interest to the organization?
(B) What are the item categories in the organization? — e.g. cables, resistors, connectors, etc.
(C) What is the Ohm range of resistances, the values which do not make any difference to the organization?
(D) What types of resistances within the range of 10-20 Ohm does the organization use?
Figure 2: Diagrammatic division of the “entity world”

(A) The division of entities (of a certain type) into entities of interest to the organization, and those not of interest to it:

(B) The division of entities of interest to the organization into different categories according to a set of category characteristics:

(C) The division of categories into groups of entries attached to every one of the category characteristics the organization is indifferent to:

(D) In every such group the organization determines the models it deals with:
A definition similar to that presented in this section may be found in the item catalogue of the U.S. Army. But neither in this catalogue nor in similar ones used, is the division into groups and sub-groups supported by as clear a logic or theory as formulated in the present study. In other work, Borovits suggests a universal concept for systematic arrangement of static data. It is suggested that the grouping within a catalogue will be built from the bottom upward.

CONCLUSION

In this article, we presented a discussion illustrating the need for a universal catalogue, its applicability in various organizations, and how an organization can adapt it to its purposes.

Although the examples used here have been small in number, the reader may extend this idea to other type of catalogues. In the era of application generators and universal software, the implementation of the concept presented here may be even easier than it seems.

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References


Angold, Linda. Cost and Time Analysis of Monograph Cataloging in a Hospital Library. Wayne State University: Library and Biomedical Records, 1979, pp. 43-68.


Lyng, G. "Remarks About the Cataloging of Open Clusters Data." *Automated Data Retrieval in Astronomy, Proceedings of the 64th Collo-


Soergel, D. "A Universal Source Thesaurus as a Classification Generator.", *Journal of the American Society of Information Science* 23(5) (September 1972) 299-305.

