Characteristics of d-National Wealth in the Knowledge-based Economy

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Based on the concept of national wealth, a new approach is proposed, being determined by the development of the information society. Currently, there are local, national and international computer networks, databases covering communities with differentiated levels of inclusion, software and many other files that correspond to data acquisition. All of these require addressing digital component of national wealth with its specific dynamics and characteristics. The paper introduced for the first time the concept of digital national wealth, an original approach named d-national wealth. Metrics are built to evaluate the characteristics of d-national wealth.
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1 The Digital Component of National Wealth

The d-national wealth has a beginning corresponding to the first electronic computer, the first program products and the first binary files [1]. The idea of d-national wealth existed since appeared punched cards. Perforation programs and keeping boxes card is a form of preservation of national wealth if the cards or other supports are:

- programs written for solving the problems brought to the final form, programs that launch the paying complete and correct after they appeared tapes and disks to the computer problem storing text, images designed on the computer, pixel by pixel, meant more complex forms of d-national wealth;
- development of equipment for data acquisition in digital form has led to sets of digital photos of animated films made on the computer, creating special effects integrated in films for the big screen;
- scanning has opened a new way in creating d-national wealth, first by converting the files of existing photos into albums, then by scanning books, magazines from libraries;
- improvement processes do not deteriorate scan old documents in archives allowed entry to places where they keep very old documents to be scanned, which happened in many situations;
- development of the Internet has led to the creation of websites works of writers with virtual museums music, youtube.com storage is an excellent source of the most varied performances;
- proceeded to develop search engines and synthesis documentation so started with e-commerce knowledge, numerous websites access condition or by creating accounts, performing mostly limited term subscription or acquisition against the cost of the product, which is first presented to convince them to pay.

The national wealth is obtained by digitization of:

- information stored on other supports such as photo paper, film;
- magnetic tapes containing live recordings of great performances on the great stages;
- any other form of recording music or other spectacles;
- documents, books in libraries, magazines and especially documents of great writers, politicians;
- roll film from secret archives or libraries that were photographed magazine articles.
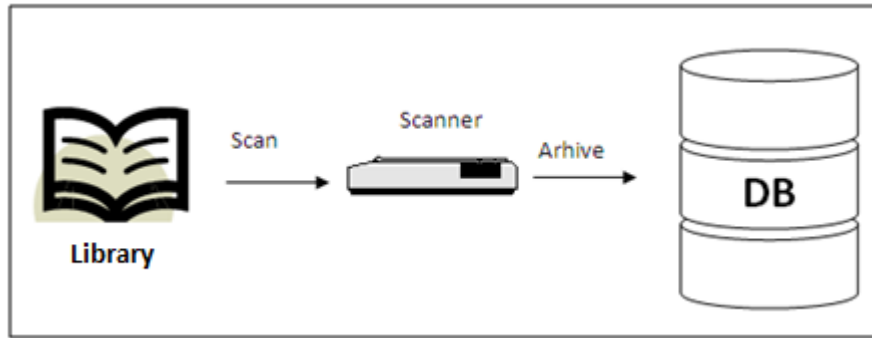
Fig. 1. Digitization process for library content

Digitization is an extremely difficult process, Figure 1, because involves:
- routine work performed by personnel with adequate training in the area that were created original media to perform a task efficiently, correctly and especially non destructive;
- period is sufficiently high because digitization process must be complete, meaning it scans all the books from the library, read and digitize all bands of audio from a Sounds Archive of broadcasting society, transfer on the magnetic support all existing films in a archive, it scans all existing documents in a library, it scans all stamps in a collective; shooting and then processes all the coins in a collection;
- purchase of equipment necessary for the non-destructive digitization means acquiring appropriate equipment, advanced that the digitization process to ensure its uniqueness;

- quality control, targeting fidelity in digital format, taking the entire content from the original and of all scanned pages, providing image clarity and coverage in a setting of all elements of on the initial support, therefore adjustments are made, and selective test is performed is quality control what is brought in digital format to no guarantee that everything is done correctly;
- content management, which aims to create complete database with information that allows retrieval of all elements included in national wealth, in this respect, if the scanned books from a library, necessarily, will be scanned format in correspondence with what is already in the library's computer system.

The creation of d-national wealth is a complex process that involve conversion of what already exist and adding in digitization process. Figure 2 present a schematic example of digitization process for multimedia content, such as roll of celluloid film, magnetic tapes, vinyl discs, etc.
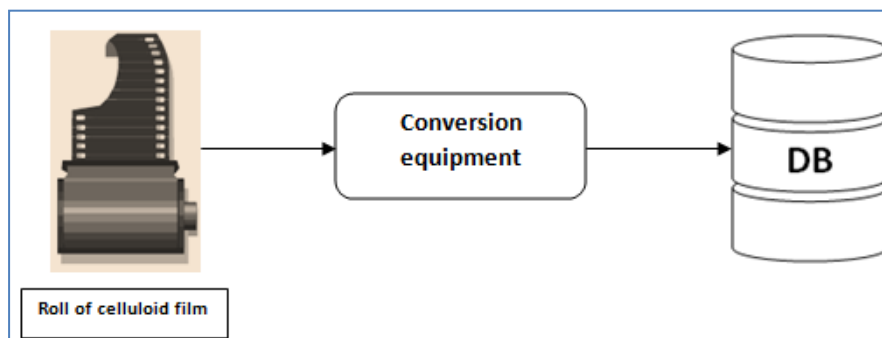

Fig. 2. Digitization process for multimedia content

Currently known elements rigorous enough about the effort required to carry out a process of digitization. For the calculations should be taken as a basis:

- financial resources to purchase number of necessary scanning equipments;
- number of necessary workers to finish this job;
- length of time to be made digitization, working extremely important because knowing this time and knowing the amount of information to be digitized we obtain the other elements: number of devices and the number of persons to be trained in the process.

Many decision makers think through digitization necessarily reduce the number of staff. The number of staff in an organization is reduced and turns through digitization manager's dream of seeing this result, is stagnant but often the number of persons in the organization increases because other opportunities that arise through digitization were unimaginable before. Existence of information in digital format allows for comparative analysis. There are new services including trade knowledge. Now appear new operations to systematize the information in their search and retrieval by keys, but the keys must be established to be validated by specialist treasury, flexible dialing key mechanisms must parameterized, this means jobs, it means persons who must perform work hours in the organization to new features that enhances organizational effort by reducing search time by providing complete information requests even it is ambiguous.

The d-national wealth has evolved over generations [2]. The hardware generations have enabled the software development, although in people imagination were defined all sorts of complicated issues. For example, the Algol language was so sophisticated that even now is not implemented.

The d-national wealth implies:
- complex programs for development of infrastructure;
- development in educational system, hardware manufacturing, software development, existence of analysts, users, customization of e-learning applications (teachers that make their own lesson without having IT knowledge);
- creating the environment for stimulating the e-commerce, the electronic payments with some discount, reducing durations, and so on;
- development of national informatics applications: the databases of police, passports, tax payments, the social security database, the database for educational system (college admissions, baccalaureate degrees, national diplomas).

Currently there is a huge variety of products in the form of files that, after a careful analysis:
- straight into d-national wealth because they are made by procedures identical to those used in the development project of systemic d-national wealth; assuming that the resolution is high, the scanner was the last generation and requirements that have been met with the same content as the pictures are originals (no missing parts or are not removed or are not overlapping with other cases of damage or digital content) clear that these files are directly integrated into d-national wealth;
- enter in d-national wealth after conducting minor operations, which are: the inclusion of several components that were neglected apparent recovery of components that are not of the quality and the elimination of components that are not part of the entity considered, improving quality through patching that eliminates some issues with the role of reconditioning, and keeping the old form, but putting it in parallel with the updated, when there is certainty that reached the level of quality required by the draft d-national wealth when component integrates;
- enter by taking some parts only of what exists, it is very well designed and components that are character document, what is good remains, is redesigned d-entity and pass its realization in digital format in the idea of to include what exists so as to form a whole with respect to what is defined in d-national wealth as a project;
- enter by adding, if websites virtual museums and exhibits must be made to

what dresses are existing site with another site that contains just what the old site plus new songs, so that the visitor not realizing that the girl has something old that something new was added, that is what was added to keep the spirit of what exists, if it was after requirements made or against d-national wealth, which is old automatically updated according to the requirements of what there is in the draft d-national wealth.

As presented in [10], the evolution of new information technology solutions creates new opportunities to promote and valorize the cultural heritage. The potential offered by mobile technologies, the huge increase of mobile devices that can process multimedia content, both offline and online, facilitates the feasibility of virtual exhibitions. In the near future, mobile devices will become the best interface for accessing cultural heritage, although studies on the type of audience that access cultural content through mobile devices are still lacking.

Figure 3 below summarize the important role of mobile devices and technologies in promoting the cultural heritage and creating virtual exhibitions that can be accessed anytime and anywhere.
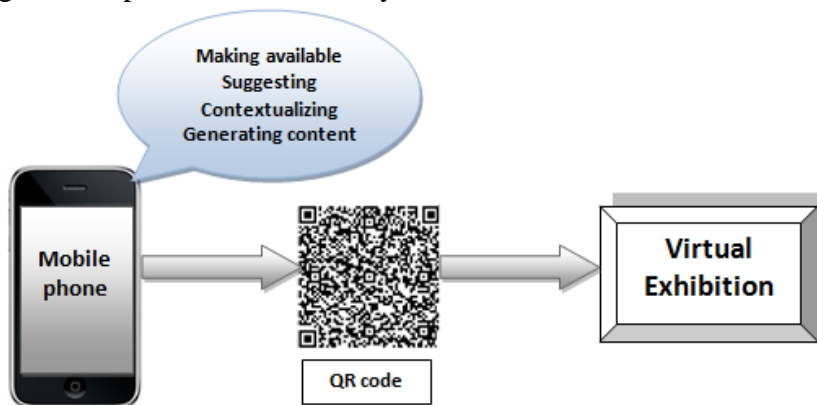

Fig. 3. Mobile technologies and virtual exhibitions

The digital component of national wealth consists of software, databases, multimedia, results from digitization processes, e-learning platforms, etc.

The d-national wealth involves a storage process and a refining process in which will be retained the best qualitative elements.

The components of d-national wealth are:
- the hardware component, creating the d-wealth of nations: computers, equipment, routers, switches, fiber optic cables, data acquisition equipment (scanner, keyboard, digital camera, microphone), design tools for building, and so on;
- the software component, which refers to informatics applications, software products, along with related files and databases.

These components have quality characteristics, such as:
- reliability (hardware and software);
- wear (hardware and software);
- portability (hardware and software);
- reproducibility, with zero costs;
- risk of damage to a single command [3];
- restoration of files, with minimum loss.

Unlike other components, the software component of d-national wealth is the result of intellectual activity.

In the case of the accessibility characteristic, unlike the other components of the national wealth [4], the components of d-national wealth are designed to provide different levels of accessibility for those who wish to interact with them:
- the *totally free accessibility* is the characteristic of those informatics applications[5], equipment, facilitating the access to resources of informatics applications and consist in elimination of any restrictions, so anyone who sits at a terminal that is connected to the Internet or to a computer that is loaded the application executable, without requiring

the creation of accounts or entering the username and password, enter in the application and select any function obtaining the complete and precisely data processing as the application was defined, the user having everything that is needed to achieve the maximum degree of satisfaction in relation with defined objective;
- the *partially restricted accessibility* requires both functions that are freely accessible, without username and password, but also functions for which the user create an account, define a username and password and set those elements which allow him to perform processing by paying a fee; in the case of some applications where users are selected, they receive username, password and after that they access the application; these applications concern the processing to be checked first by virtual users, which means that they process their data for a limited time, after which they must to subscribe and pay to continue;
- the *restricted accessibility* is the feature of informatics applications that address user groups oriented on types of processing

involving resources allocation with making payments or additions, alterations, respectively, removal of information; these informatics applications require the rigorous identification of users since there are responsibilities related to the nature of transactions by generated effects; in e-learning systems the tests require strict assessment on student [6]; in electronic payments systems there is identified the account of the payee as well as the account of beneficiary that receives the amounts;
- the *certified accessibility* is a new type to obtain resources or to provide resources in the informational plan, the authentication being performed by electronic signature; the way how the electronic signature is defined gives the same value as a handwritten signature and even more.

The quantitative side of d-national wealth is translated into kilometers of optical fiber, number of computers, number of servers, number of internet subscriptions, number of users, number of databases, and so on.

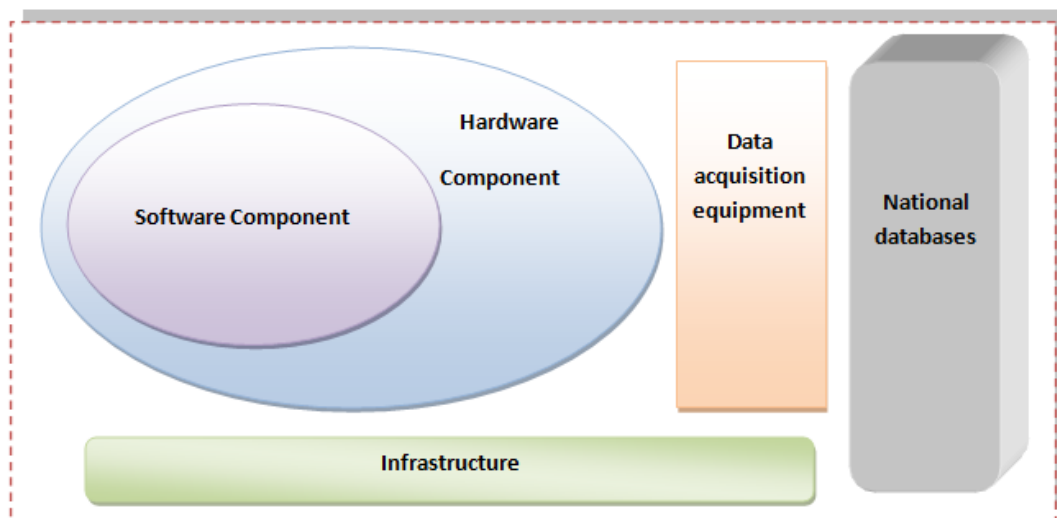The d-national wealth architecture is shown in Figure 4.

Fig. 4. The d-national wealth architecture [1]

All of these are designed to create an image of what is and what should be done in the future (investment funds, development policies, etc.).

These indicators are for guidance only, they are dynamic, heterogeneous, and by their aggregation an indicator is resulting that gives an approximate image of d-national wealth.

2 Metrics of the National Wealth Digital Component

From the point of view of users, the existence of public d-national wealth is a very important element to increase the level of culture, information and documentation in making reports, articles or other own materials. Number of people accessing d-national wealth depends of its quality. Quality of d-national wealth depends of:
- completeness digital content required by each user;
- accuracy of the data;
- clarity of the presented elements that describe a certain reality;
- consistency.

The metrics of national wealth digital component are represented by:
- computing capacity;
- internet access capability;
- other indicators (number of users);
- volume of software products;
- volume of databases;
- complexity indicators for software, databases, digital content, national wealth.

Transformation coefficients are used for homogenization; they are not weights, but equivalence factors, on the effort to achieve and on complexity. An instruction has machine cycles. If a MOV instruction in Assembler has 5 machine cycles and a MUL instruction takes 20 cycles, then 1 MUL = 4 MOV. It must be identified the basic element that ensures comparability.

The value of d-national wealth means to establish a number that is the expression in national currency or any other currency of the d-national wealth level.

The d-national wealth value in a country, *DNW*, can be estimated with the following indicator:

$$DNW = \sum_{i=1}^{nhw} p1_i * HW_i + \sum_{j=1}^{nsw} p2_j * SW_j$$

where:

HW_i – the value of the hardware component i;

SW_j – the value of the software component j;

$p1_i$, $p2_j$ – equivalence factors;

nhw – number of hardware components;

nsw – number of software components.

This approach introduces:
- approximation generated by the failure to include components;
- selective character given by the model used;
- subjective approach by prioritizing after important criteria obtained from a sub-collectivity of specialists, even if it is representative, this is not demonstrated.

The value per capita of d-national wealth is interesting if:
- is used to compare different periods in the same country (300 RON in 2009 versus 700 RON in 2012);
- using the same methods of estimating the d-national wealth for the country i and the country j in a certain year (300 USD in Romania versus 2000 USD in Japan) or if we have different methodologies, but we have also equivalence algorithms.

The value and structure of d-national wealth are important for:
  - funds allocation to purchase equipment;
  - defining strategies for future development.

The study of d-national wealth must be addressed in the idea of establishing the ways for modernization of equipment and increasing the skills level.

D-national wealth is for users not for developers, so it is an application oriented citizen and:
  - has characteristics given of this type;
  - development cycle is designed to start from the analysis of the target group;
  - structure is focused on the inclusion of components that maximizes the absolute satisfaction level;
  - is dominant the profile of each user.

If d-national wealth fulfills the quality requirements, is calculated the absolute satisfaction level of users, ASLU, given by the formula:

$$ASLU = \frac{NUF}{TNU}$$

where:

NUF - number of users who have visited d-national wealth have used the product requested directly from the first, the user uses a time and do not request the same thing to look for something else;

TNU - total number of users who entered and used or out without finding what they were looking, they came first or open files and close them quickly dissatisfied by what they found there.

Relative satisfaction level, RSL, is given by:

$$RSL = \frac{NUT}{TNU}$$

where:

NUT - the number of users who have tried several times using the same combination of keywords to open some files, until they found something in each.

TNU - the total number of users.

Another indicator that answers to d-national wealth requests is $INCL_i$, representing the ease to access a component by a certain user in a d-national wealth application:

$$INCL_i = \frac{min_{i=1}^{NU}\{NC_i, NT\}}{max_{i=1}^{NU}\{NC_i, NT\}}$$

where:

NU – total number of users that access the d-national wealth application;

NC_i – the number of clicks made by the user I to reach the desired component in the application;

NT – the tree depth of the application represented in number of clicks.

D-national wealth is an open system with the ability to take over as new elements for national wealth itself changes day by day, month by month, year by year. Acquisition of new components is achieved through automated analysis of content such that:
- not repeat d-entities;
- to manage redundancy such that only new items to be added and old ones just to be referenced in the new d-entity added to the d-national wealth;
- to make complex analysis and build of nearby d-entities which increase their complexity;

- will be automatically correctness analysis to see concordance between elements introduced and existing;
- if it is move to a higher stage in the semantic analysis of the digital content, it will definitely improve the quality of entire d-national wealth application;
- picking up information about users will find new items from raw data to define new operations on search keys, new indicators for defining profiles.

3 Ways to Increase the d-National Wealth in the Knowledge-based Economy

Knowledge-based economy is one in which ideas and technologies are considered the ingredients of innovation. The importance placed on education and human capital in a country's economic growth represents the key element for the implementation of knowledge-based society. In the knowledge society, the processes of creating, sharing and use of knowledge have the sole objective of increasing the welfare and prosperity of mankind [7].

Availability of mass storage makes up discussions on addressing d-national wealth to be and remain an open question because:
- the list of entities to be included in d-national wealth as digitization process is open, each person having the right as on the basis of arguments to include new elements, while also making clear enough descriptions and making demos, so that through these new elements do not introduce elements of ambiguity;
- the presentation and digitization are extremely different, forming applications developed themselves according to views that depend on the instruments used in the conversion process;
- level of detail is also open as a hierarchy level, the existence of a strategy for achieving d-national wealth defined priorities; such an approach to the issue comes to rethink the way of the computer application development in a constructive way, idea to realize that grows by adding components and to ensure maintenance of existing components, should be excluded

frequently occurring idea to replace an application in progress with another, who will be replaced when it is still in progress with another not finished what was started.
- inventory should be done using what currently exists;
- openness should be combined with ensuring that d-national wealth is being conducted under a collaborative system, the most complex collaborative system, communication between organizations must be made to the definition of procedures their acceptance and to achieve a stable process the idea that will not come to the end of the major changes affecting the completion of digitization and lag; should be accepted as it will speak to generations of agencies national possessions strictly related to the management stuff but mainly by developments in computer technology.

It is important that each person who accesses on d-national wealth to register all related items:
- vocabulary keywords;
- type of d-entities accessed;
- frequency and using of information;
- repetitiveness;
- depth approach.

The ways to increase the d-national wealth include:
- reorganization of digital content;
- decrease of damages;
- reuse through integration and conversions (a very good program in COBOL is rewritten in C# or C++);
- storage, archiving without destruction;
- support economies
- things to increase the security level.

The ways to increase the d-national wealth are:
- the development of new software production processes to make art products and to ensure consistency between hardware, software, the administrator and ever increasing customer demands that are increasing their number from one stage to another;

- establishing rigorous procedures for managing versions of digital content to not be lost through deletion, deterioration, upgrade or conversion of content structure; these procedures are designed to manage versions and allows to retrieve that version from a lot of versions that represents the starting state in relation with an established object;
- preservation of software products, databases, multimedia files and all other components of d-national wealth being currently in use, so as to keep the functionalities for which they were created, thing which is achieved by structuring the interface messages and creating streams which limits unauthorized or uncontrolled access to software components;
- introduction of components that ensures informatics security at the level of organization's information system, because building of different levels of security on each component aims to produce contamination, including components with high security level through effects caused by their contact with unsecured components on which informatics attacks were carried out, with negative and uncontrolled consequences on the entire system;
- creating programs that perform data acquisition leading to the conversion of documents archives, movies, music, books and magazines deposits to digital format, allowing an increasing number of people to access the specialized digital content;
- introduction of restrictions on the use of existing digital content, knowing that the use of copy-paste commands does not create national wealth; restrictions are meant to cause anyone who develops applications to bring new contributions, so that each component to encompass new value, only in this way obtaining significant contributions to d-national wealth;
- the use of quality metrics for digital content leading to establish the moment when an informatics product is considered

a component of d-national wealth, because not every file or database or multimedia components or any site or any other web product automatically becomes a component of d-national wealth;

- providing a controlled level of redundancy, without exceeding acceptable limits, because taking through copy-paste parts of existing components in d-national wealth enables versioning; it is important that each developer takes into account the dynamics of its products, so as to launch in use the latest version, which should mandatory contain all the features of the previous versions; otherwise, it is necessary to simultaneous circulate multiple versions, making it difficult to approach, especially when from one version to another large differences occur and the final version require mandatory supplementary hardware components and the user has no way to select with which version he want to work after he has entered into the application;
- achieving a balance between multiplication by a template of the applications for which generators were built, as there are now tools with which are built assisted virtual shops or structure of informatics systems, the ERPs being included in this category because the customers task is to parameterize them, in this way being stimulated the creativity;
- allocation of funds in software development organizations for innovative large applications to generate those directions which ensure consistency between what is produced there, in current manner, with what is on the market of the latest technologies and tools.

In the context of transition to knowledge-based society, organizations have undergone various changes, depending on their nature. As a company, such as a bank, does not justify its existence without making a profit, in an institution of economic higher education, the main objective is to meet the educational needs of its members. In recent years, a trend of increasing the number, weight and importance of institutions was manifested, while the company remains the most important organization [7] [8].

In Romania is developed a project named BNP – National Library of Programs (Biblioteca Națională de Programe – in Romanian), which has the main purpose to collect and manage information about software products for public administration and business environment. Though this project, degree of information and documentation of software products from d-national wealth is increased.

The project has an online platform where the software products are registered and information about this product is saved in database. The software products are delivered for using, in accordance with their ownership rights. BNP ensure certification of products' functionality.

4 Conclusions

The d-national wealth is the result of a generalized collaborative process, involving coordination and especially homogenization, so that the difference between software of first generation and the latest generation software to not exceed the last 2 or 3 generations.

There are many criteria for classification as d-national wealth consists of a wide range of components and these criteria are meant to realize homogeneous sub-collectivities needed to choose those components that satisfy the requirements of some groups of users.

The knowledge-based society requires a high level of d-national wealth because it assumes the existence of knowledge bases, of applications that perform processing, and so on. The knowledge-based society has evolved with the advent of computers and informatics development; changes have taken place in the training level of people, producing an intellectualization of work processes.

The openness of d-national wealth creation must be combined with ensuring that the d-national wealth is conducted under a collaborative system, the most complex collaborative system ever defined.

The communication between organizations must be made at the level of procedures definition, their acceptance and the achievement of a stable process, in the idea that it will not come at the end with major changes affecting the completion of digitization and lag. It should be accepted that we speak about generations of d-national wealth, strictly related to management stuff, but mostly to developments in computer technologies.

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