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INFORMATION LIFE CYCLE AND ITS COMPUTER SUPPORT

Abstract: The paper focuses on the concept of the information life-cycle and its characteristics. Both a simplified and an extended models of the information lifecycle are discussed. In addition, a computer-aided Information Life Cycle Management strategy is addressed, including its role in the management of information resources and the optimization of specific stages of the information lifecycle in an organization.

1. Introduction

Today information plays a key role in operations of business organizations. Information is a strategic component of modern business. Therefore, it is not surprising that it is treated as information **capital**[1]. Thus, effective methods of its management are necessary in the course of its life cycle in an organization[2].

The idea of information lifecycle is worth mentioning here. This is not a new concept: in fact it refers to the biological life cycle (from birth, through youth, maturity to death) or the marketing[3] idea of the lifecycle of a product introduced on the market.

The purpose of this discussion is to assess:

- whether and to what extent the information lifecycle can be considered in a (business) organization;
- how to specify individual stages of this cycle (a simplified and an extended models are proposed);

[1] See: [Dziuba 2005], [Dziuba 1998].

[2] This paper is based on the author's considerations in [Dziuba 2007].

[3] Each product introduced on the market has its own life cycle. This cycle is defined as a period in which the product finds its purchasers and satisfies consumer needs. Typically it covers four stages: market introduction (I), sales growth (II), saturation to maturity (III) sales decline (IV), and then the obsolete product is withdrawn from the market.

- what are specific features of the information lifecycle (and its specified stages), what are main relations between stages; and
- how to manage the information lifecycle in the organization using an (IT-supported) *Information Lifecycle Management* (ILM) strategy; and
- what role does this strategy play in managing information resources of the organization and optimizing (selected) stages of the information lifecycle, i.e. what are possible benefits and limitations?

The discussion treats information as a resource (in an organization) or the product of an information process. Nonetheless, information can be treated **differently**: as a service, a commodity, free good, the element of an enterprise infrastructure etc.

This paper presents the following issues: specific attributes of information; the idea of its life cycle (simplified and extended models are suggested here); specific characteristics of the information lifecycle; the *Information Life Cycle Management* strategy and its role (potential benefits) in managing information resources of an organization.

2. Specific attributes of information

Information has several specific attributes as compared to other (traditional) resources, including:

- it can substitute for other resources,
- it needs to be updated,
- it can be reproduced and transported, i.e. transferred in time and space,
- it can be processed (transformed) to obtain new information,
- it is not subject to wear and tear in use,
- contrary to material assets, it can be shared without any loss.

It is very durable and can be accumulated over a very long period. From the perspective of a society it is an advantage but for an enterprise it is a drawback. Gathering information generated for example in a millennium poses huge technical problems.

On the other hand, there are some similarities between information and other resources:[4]

- information is acquired for a specific, measurable price;
- it has a value that can be measured and treated as a measurable resource;
- the consumption of information can be quantified;
- cost calculation techniques may be used to support information cost control;
- information can be processed and refined, similar to rare assets; other resources (databases) are transformed into finished products (e.g. published catalogues);

[4] See: [Burk, Horton 1988], [Meyer 2005].

- substitutes are available for each specific piece of information and can be calculated in terms of higher or lower costs;
- for management purposes, it is possible to select different classes, types and costs of information.

3. Information lifecycle concept

As far as information is concerned, we can identify and analyze its lifecycle. For example, it is possible to identify the following information lifecycle stages in an organization (see: Figure 1).

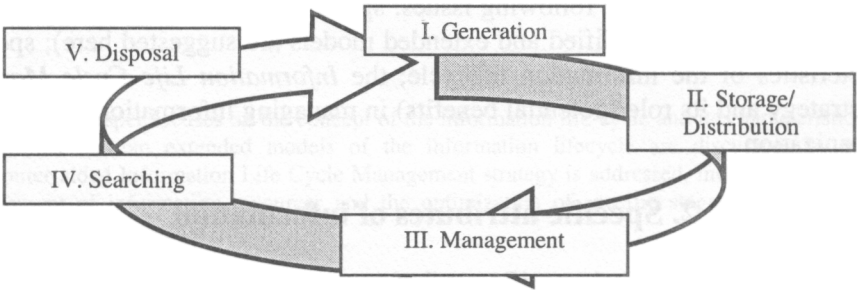

Figure 1. Lifecycle of information as the element of knowledge
Source: own elaboration.

The chart presents, in a simplified manner, five stages[5] of information lifecycle. It starts with the generation of information and building knowledge upon it as included, for example, in corporate documents, both traditional (on paper) and electronic such as web sites, emails, audio/video files etc.

Then this knowledge is distributed internally and externally (stage II). To this end, various methods are used, e.g. available IT systems, databases, the Internet, intranet etc.

The diversity of information distribution tools makes it necessary **to manage** these resources (stage III), i.e. to monitor, protect, optimize, update. The next stage of the lifecycle includes searching for information with a view to obtain a specific information (for own needs or to share it) and its analyzing. Then (stage V) knowledge is developed and used to satisfy identified needs for information.

The applied knowledge, in turn, often gives grounds to create **new** information (knowledge) and a new information lifecycle so begins. It follows that information **never** ends or is exhausted. Nonetheless, we will show that information may be disposed of, e.g. information archived by an organization.

[5] Prepared based on: [Feldman, Sherman 2001, pp. 3-4].

4. Supplements to the model

The information lifecycle presented above is of a model nature (see: Fig. 2). Various enterprises (organizations) feature different cycles, depending on their specific functional needs.

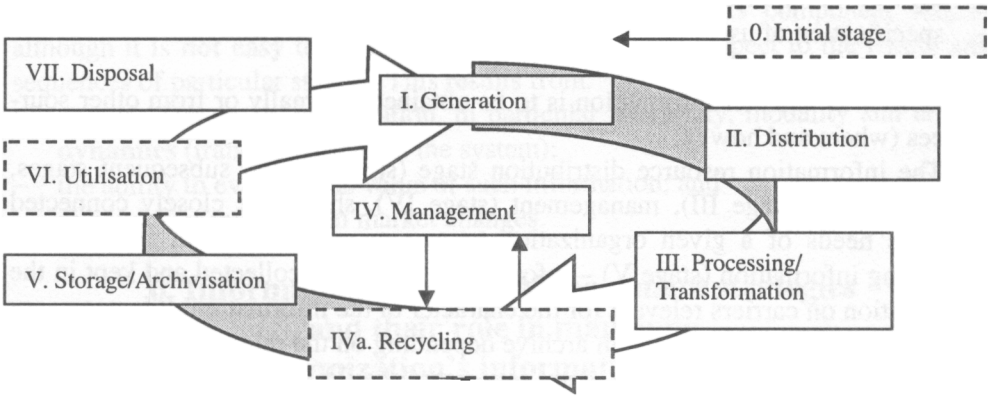

Figure 2. Information Lifecycle in an Organization
Source: own elaboration.

There are **several loops** (not presented on the chart) between the specified stages, e.g. between information processing and its gathering, managing, recycling, distributing or generating. In addition, the transformation stage (resulting from e.g. processing, management, resource monitoring) "distorts" other stages of the lifecycle subject to our analysis: making them longer (more often) or shorter. Other possible stages include information disposal, its destruction or repossession – as a result of recycling.

Organizations **maylose** information, e.g. by missing it. One example[6] is quite characteristic here. NASA has collected data from various space missions for over 30 years. To date, three thousand photos from the Viking Mars mission 1975 have not been processed. Why? NASA's documents describing procedures for data and information input (including access keys) were rendered in a highly technical jargon. This jargon appeared to be incomplete for people who tried to decipher it 20 years later.

Figure 2 presents seven stages of the information lifecycle[7]. The initial stage ("0") refers to, *inter alia*, defining information needs, requirements for information

[6] See: [Leonard-Barton 1995].

[7] Prepared based on: [*Management of Government Information Holdings*...1995]. Op. cit. specifies five stages: the initial stage – information product planning; stage II – information gathering, generating and receiving; stage III – organization (of information resources), transmission, use and search; stage IV – collection, protection and retention of information; stage V – information disposal through its transfer or destruction.

(as soon as possible). Business organizations should identify their expectations regarding information. They should identify expectations for each stage of the cycle. This stage should specify what information should be collected, generated or received. Generation (stage I) results from:

- the nature of information needs (what should be developed/obtained?),
- legislation requirements (why?),
- specification of users and user groups using information (who?),
- nature/frequency of user need (when?),
- as well as whether information is to be obtained internally or from other sources (where and how?).

The information resource distribution stage (stage II) and subsequent stages, i.e. processing (stage III), management (stage IV), should be closely connected with the needs of a given organization to maximize the value of information. Collecting information (stage V) – information should be collected and kept in the organization on carriers relevant for the character of the information. It is necessary to define the period of keeping in archive depending on the relevant business needs (and legal requirements). The data resources should be adequately protected against unauthorized access, loss, modification or damage. Stage VI is the stage of disposing of or deleting the information when the organization no longer sees it viable to keep it, in line with the relevant operating and legal (political) concerns.

The information that has no perspectives of being used or is expendable for the organization **may be deleted** from the system. The final stage is the application of the information for concrete needs.

5. Information life cycle – specific features

As demonstrated above, information has a special and complex life cycle. The following interdependences should be noted:

- the lifecycle of information is a sequence of several stages; usually these stages comprise generating, collecting, processing, using, gathering and disposal;
- these stages develop loops;
- the lifecycle of information may be **longer** than the biological life time or the lifespan of equipment or memory banks storing the information;
- information is developed, it has a specified usable life and may **lose** its value and be destroyed;
- information may be recovered (in **recycling** processes);
- information is affected by the passage of time (organizations incur losses when they loose their information resources);
- the value of information **varies** over its lifecycle;
- the length of individual stages (and the whole cycle) is variable.

The **length and sequence** of particular stages depends, among other things, on:

- the individual pool of information, i.e. its value;

- individual utility;
- specific nature of the (business) organization;
- used technology (e.g. of archiving);
- legal considerations, such as the statutory storage periods of particular data/documents (e.g. in public administration, archives etc.).

In conclusion: information **has** its life cycle (with its component stages) although it is **not easy** to estimate in advance (e.g. with respect to the length and sequences of particular stages). This results from:

- specific features of information, in particular its variety, modality and unique **dynamics** (transformations in the system);
- the ability to evaluate the value of such information; and
- dynamics of information market changes.

6. Information Lifecycle Management strategies and their role in managing the organization's information resources

Every day business organizations generate, use and process various streams of information. However, the recent years have seen a great flood of information, including "junk information". Organizations' data volumes increase rapidly.

The staff accumulates innumerable emails, documents and other files that they do not view or update or delete. For example[8], a complex of Boston hospitals at present holds 70 terabytes of data gathered in disk memory and 100 TB on magnetic tapes. This volume grows 2.5-fold every year, so the total capacity of the stored data approximates to 1 PB (sic!). This level of memory capacity has become typical in many large business organizations, such as banks, insurance companies, etc.

Additionally, calculates of the Berkeley School of Information Management and Systems in University of California (2003) show that in the global scale:

- e-mail systems generate approximately 400,000 terabytes of new information;
- almost 800 MB of recorded information is generated annually per person (that is each person out of the six-billion population).

Therefore, it is a must to have methods in place for reducing and optimizing this pool of information (in particular electronic information).

One of the worthwhile concepts is the *Information Lifecycle Management* (ILM). ILM is an IT-supported strategy for **long – term** gathering and the use of information for the purposes of the individual organization. For example, *Storage Networking Industry Association* defines ILM as[9] *"the policies, processes, practices, and tools used to align the business value of information with the most*

[8] Prepared based on: [Davenport, Cohen 2005, p. 5].

[9] See: [Controlling information storage costs may be in the CARDs, 2005].

appropriate and cost-effective IT infrastructure from the time information is conceived through its final disposition (...)".

This includes the following:

- managing computer memory and their resources, e.g. by storing information of greater value of more expensive data carriers with the less valuable resources migrating to other memory arrays;
- using specific hardware platforms and architecture,
- using various security techniques,
- using "intelligent" IT systems (*Business Intelligence*) for searching and managing data/information resources gathered.

In practice, ILM is often understood in a narrower sense: a strategy for data management[10], computer memory space management in the organization, or business data archiving techniques[11].

Particular attention is paid to the adequate methods of content optimization or classification and evaluation of business information. The methods used for organizing resources are a paramount for their **later use**, querying or archiving in the context of the organization's specific features.

ILM software applications are presently offered by reputable vendors such as IBM (*TotalStorage* solutions), HP, Sun Microsystems, Oracle, Fujitsu or SAP – mySAP *Product Lifecycle Management* (PLM).

The IT systems related to ILM strategies[12] support, without limitation, automatic management of resources, their protection, optimization of computer memory infrastructure, information and metadata management, planning and ongoing monitoring (measuring[13]) of the infrastructure. Upon an effective implementation of this strategy the existing resources are more easily and more swiftly accessible (to various groups and for various needs). This applies in particular to the data/information that is most commonly used in practice, or to critical resources.

7. Conclusions

The ILM strategy offers a large number of (potential) benefits to businesses, esp. large enterprises. It allows to:

- more effectively manage various resources of electronic information in line with pre-established priorities;
- optimize **information lifecycle** in an organization;

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[10] Data Lifecycle Management.

[11] Initially, the ILM has only been developed for managing documents of the organization.

[12] It is sometimes perceived in a broader context of *Infrastructure Management systems*, *Business Intelligence systems*, *Business Performance Management systems* or *Enterprise Content Management*.

[13] Including measurements based on balanced scorecard.

- as part of the above – reduce "junk information" and other redundant information resources;
- have knowledge (metadata) of the location of all information resources, their value and content;
- ensure swifter access to selected categories of information (the "more valuable" information in terms of the organization's strategy, frequency of use, etc.), wherever it is located;
- which enables a faster decision making process and reduces the time of reaction to market impulses (*time-to-market*);
- more effectively protect the resources and infrastructure, also in the event of IT system emergency situations (including *disaster recovery* methods);
- reduce the **costs** related to the above, e.g. by optimizing/reducing the costs of data gathering, data carrier costs[14], resource management, etc.;
- however, the ILM strategy has been so far focused on **selected stages** of the information lifecycle (this applies in particular to archiving, utilization or distribution).

The economic effectiveness of investments in the ILM technology is difficult to evaluate. Such complex systems have only been in use for several years[15] and there is no credible information regarding the effects of their implementation or case studies. In spite of high implementation **costs** of the ILM technology and the absence of established standards, some forecasts show that enterprises express their interest in this strategy. In 2004[16], the worldwide market for storage-management software licenses achieved $5.6 billion. According to research[17] conducted in December 2004 by a consulting firm Gartner[18], 12% of the respondents had already been implementing ILM projects, one in three respondents intended to do so in 2005, and one in five in 2006. Therefore, ILM is a vision for the future.

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[14] E.g. reducing the total cost of ownership (TCO).

[15] It first appeared in the specialist literature and on technology providers offers in 2004/2005.

[16] According to Gartner; see: [Henrie 2006].

[17] See: [Short 2005].

[18] Research based on 95 large organizations.

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