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Digital information management
possible paths

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ABSTRACT

Introduction: Since its beginnings, society has sought to register its information and thus information technology tools occupy a prominent place in society, and are considered indispensable for scientific, social, technological and economic advancement. Objective: With this common thread, this article seeks to present a reflection on the concepts of Digital Information Management starting from the characteristics, problems and challenges of digital information. Methodology: The methodology consists of a bibliographic-documentary survey, composed of published materials, among them: books, theses, dissertations, texts on internet sites and articles in scientific journals, constituting a literature review, which mainly addresses works of expression in the area, published by authors who research the theme of digital information and its management, opening a way for new discussions on this theme. Results: In this way, the collected data are processed through qualitative analysis, and later, structured in thematic sections, point out the main theoretical mishaps. Conclusion: The results point to a major challenge that must be overcome for efficient data management, which are the existing restrictions on digital preservation both in terms of technology and software obsolescence, file formats, availability and perpetuity of repositories. Another issue that has to be considered is the one referring to the PGPD data protection legislation that imposes and regulates a series of rules for the recovery, treatment and use of personal information of natural individuals.

KEYWORDS
Management. Digital information. Digital information preservation. LGPD.

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Gestão da informação digital
caminhos possíveis

RESUMO

Introdução: A sociedade desde seus primórdios busca registrar suas informações e dessa forma as ferramentas de tecnologias da informação ocupam um lugar de evidência na sociedade, e são consideradas indispensáveis ao avanço científico, social, tecnológico e econômico. Objetivo: Com esse fio condutor, este artigo busca apresentar uma reflexão sobre os conceitos da Gestão da Informação Digital partindo das características, problemas e desafios da informação digital. Metodologia: A metodologia consiste no levantamento bibliográfico-documental, composto por materiais publicados, dentre eles: livros, teses, dissertações, textos em sites da internet e artigos em

periódicos científicos, constituindo-se uma revisão de literatura, que aborda principalmente trabalhos de expressão na área, publicados por autores que pesquisam a temática da informação digital e da sua gestão, abrindo um caminho para novas discussões sobre essa temática. Resultados: Desta forma, os dados coletados são processados através da análise qualitativa, e posteriormente, estruturados em seções temáticas apontam os principais percalços teóricos. Conclusão: Os resultados apontam para um grande desafio que deve ser superado, para uma gestão de dados eficiente, que são as restrições existentes na preservação digital tanto no quesito tecnológico como a obsolescência de software, formatos de arquivos, disponibilidade e perpetuidade de repositórios. Uma outra questão que tem que ser considerada é a referente a legislação de proteção de dados PGPD que impõem e normatizam uma série de regras para a recuperação, tratamento e uso de informações pessoais de indivíduos naturais.

PALAVRAS-CHAVE
Gestão. Informação digital. Preservação da informação digital. LGPD.

CRediT

JITA: JH. Digital preservation.

1 INTRODUCTION

Society has sought to record its information since its beginnings, and thus information technology tools occupy a prominent place in society, and are considered indispensable to scientific, social, technological and economic advancement. We cannot imagine the world today without digital information, which breaks down barriers and underpins the creation and permanence of the knowledge generated by a particular group.

In this scenario, digital information becomes a driving force in the development of the individual and of society, and the way to manage this information is the great differential in the daily work of the information scientist. It is important to understand how this digital information is constituted and the ways of managing it have been a concern of its producers and managers.

Digital information brings a series of benefits such as availability, reproduction, storage and retrieval facilitated by information systems that can help us in this process. In the same way, digital information brings new challenges in an ever-changing environment; how to handle this information? The process of storage is not as simple as it seems, because there are restrictions of hardware and software technology that may hinder the retrieval of information. We also have restrictions imposed by legislation, which are necessary to protect the information of individuals, but which represent restrictions on the use and retrieval of this information.

In short, the treatment of digital information brings immediate and future challenges to the information science professional, posing challenges that must and need to be overcome so that we do not run the risk of losing information that may be important both from a personal and business point of view.

1.1 Methodological Path

The methodology used consists of a bibliographic-documentary survey, composed of previously published materials, including books, theses, dissertations, texts on Internet sites and articles in scientific journals.

It is characterized as a literature review, which addresses, in addition to authors who have been researching the theme for a long time, also the works published in recent years, a period in which the discussions on digital information management have been firming and becoming more relevant. In this way, the collected data are analyzed through the qualitative method and structured in thematic sections, thus pointing out their main theoretical mishaps within the digital world (GIL, 2010; SILVA; MENEZES, 2005).

2 DIGITAL INFORMATION AND ITS RELATIONSHIP WITH CURRENT INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS)

Defining information takes us, firstly, to classic authors to build our understanding of the theme. For Capurro and Hjorland (2007) information is the process of transformation of knowledge and, particularly, the selection and interpretation within a specific context. It thus has a sender and a receiver, who interact through some channel, and may interact through writing, speech, by an image, there are infinite ways to present this information.

This knowledge is generated from the triad - data - information - knowledge, what we can verify here is that the information starts as a data, but it turns into knowledge from the moment the individual transforms it into something useful for himself or for society. What for Le Coadic (2004, p.4, our emphasis) information is presented as:

> [...] a knowledge inscribed (registered) in written form (printed or digital), oral or audiovisual, on a support. Information contains an element of meaning. It is a meaning transmitted to a conscious being by means of a message inscribed on a spatio-temporal support: printed matter, electrical signal, sound wave, etc. Inscription made thanks to a system of signs (language), a sign which is an element of language that associates a signifier with a meaning: alphabetic sign, word, punctuation mark.

Information has an aspect of valuable resource, both financially and in the evolution of an individual or society, considered the basis for the generation of knowledge and the creation of assets from the organizational perspective. For Valentim, Jorge and Soria (2014, p.210)

> The changes that permeate the society as well as the speed as a determining factor of the information revolution have highlighted the need for an element responsible for the learning process in relation to information, helping and boosting the knowledge generation process, thus arising the need to provide competence to individuals in the information field.

Society is changing throughout history and information and its support and management forms are also following these changes. For this information to be effective in the search for creating knowledge and thus modify the individual, society and organisations, it must be administered and managed appropriately.

The search pervades skills to manage this information, but also the informational flow, supports and the users, so only with the focus of generating knowledge in decision making that leads to create a personal and financial asset for an individual, organization and the society. (MENDONÇA; VARVAKIS, 2018).

And this digital world interferes in the way information is information, there is a new form that is technology, formerly information was only recorded in a physical support and its existence was visibly palpable, now we live in a time that information is found in the most varied formats and organised in various ways too.

In Ursula Blattmann's thesis (2001) the author sought to define a management model for digital libraries and in the meantime her research was focused on the digital perspective and the speed with which digital information is transmitted that overcomes geographical barriers, supports, formats and forms of consumption of this information. In this, the Information and Communication Technologies (ICTs) have contributed greatly to this faster transmission and without georeferential obstacles and for this there are models that can be of "[...] highly subjective approximations, for not including all observations, measurements and associated measurements, but, as such, are valuable for hiding secondary details and allow the emergence of the fundamental aspects of reality". (DUTRA; BARBOSA, 2020, p.116).

Starting with the evolution of technologies and the creation of the internet that culminated with an informational explosion and also the excess of information sources that generated a lack of reliability of the information obtained in digital sources (DUTRA; BARBOSA, 2017). For Shapiro and Varian (1999, p. 17) this "[...] digital information can be copied to perfection and transmitted instantly around the world, which leads many content producers to view the Internet as a giant copier, out of control" and also the "[...] information that originates, processes and is communicated on the web and may come to have its access interrupted or changed." (FERREIRA; MARTINS; ROCKEMBACH, 2018, p.95).

In the 1990s there was already a concern with the use of the Internet, something that currently has become a recurring discussion and a search for the organization, use, retrieval and storage of this information in a faster and more reliable way. The search for an efficient management of this information has been sought for some time, which we can see in Chart 1 that exposes this evolution and its use over time.

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Chart 1. Evolution of Information Management

Decade	Information Vision	Management objective
1950	A necessary bureaucratic requirement.	Reducing the cost of processing many papers;
1960 e 1970	A support to the general purposes of the company.	Assisting in the management of various activities;
1970 e 1980	A control and management factor.	Assisting in decision-making processes;
1990 até os dias atuais	A strategic resource.	Transforming it into a source of competitive advantage to ensure the survival of the company.

Source: Based on Dutra and Barbosa (2021).

This measurement and monitoring of results is essential, according to Dutra and Barbosa (2021) for an effective process of digital information, of course there are factors that hinder, delay, bureaucratise this management, so the search for models that are actually implemented in order to review, supervise, evaluate, maintain and feedback the system of the information management process.

3 THE IMPACT OF ARTIFICIAL INTELLIGENCE (IA) ON INFORMATION PROCESSING

Artificial Intelligence (AI), has several definitions, and can be identified as the intelligence demonstrated by an artificial entity (machine/computer), which generally follows or mimics the characteristics and thinking analogies of human intelligence and perform actions like humans, through the combination of large amounts of data, intelligent algorithms and fast processing.

AI can also be exemplified from some ideas (LONG; MAGERKO, 2020): computers can learn from data; perceive the world using sensors; agents maintain models of the world and use them to reason, making agents interact with humans is a substantial challenge for AI developers and AI applications can impact society in positive and negative ways. These ideas may become some of the foundations that guide future applications of AI in Archives and Libraries.

In turn, the issues of knowledge organization, classifications, taxonomies and ontologies are directly related to machine learning applications, or *Machine Learning*, with the use of models that can learn from data, and this learning can happen in a supervised, semi-supervised and unsupervised way.

For the construction of Intelligent Archives and Libraries it becomes necessary to form a basis from Artificial Intelligence and Intelligent Expert Systems. In general, many new terms come together in the Artificial Intelligence umbrella and can be observed in the analysed papers, such as expert systems, rule engines or rule-based systems, machine learning, deep learning, neural networks (ROLAN *et al.,* 2019), but also natural language processing (NLP) and computer vision.

The application of statistical models and computational processing, for instance, help in the establishment of machine learning forms, which can be applied by feeding the model with texts, images and several types of data. The quality of information or IQ (*Information Quality*) can be understood by intrinsic issues (accuracy, objectivity, reliability), accessibility

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(access, security), contextual (relevance, added value, timeliness, integrity, quantity of data) and representational (interpretability, ease of understanding, concise and consistent representation) (FLORIDI, 2014).

According to Griffey (2019, p.6) in Librarianship and Information Science we can consider artificial intelligence as the broadest category and stay with automatic *learning* or "*machine learning*" for reference to specific systems. AI is a useful technology for IC professionals and according to Gomes (2022) nowadays, we already have several services that provide faster and more accurate publication summaries and indexing, information search and retrieval services through new platforms that connect multiple search points, voice services and *chatbots* that provide reference works, smart libraries, content classification services using ontologies, automated metadata creation.

These are just a few examples of services and implementations using the concept of AI. AI can be useful to traditional information services, but also brings concerns about privacy, intellectual freedom, authority and access (GARCIA-FEBO, 2019). At the beginning of the third decade of the 21st century, it is found that:

> [...] the impact of AI is of first order in tasks related to information processing, not only in work that can be considered more mechanical, such as cataloguing, but also for those that required greater human intervention, such as indexing, metadata assignment or content description; the effects of AI are visible in the service provision itself, with results in the transformation of physical spaces and resource management (GOMES; FERNÁNDEZ MARCIAL; SANTOS, 2021, p. 403).

Bezerra and Almeida (2020, p.6) draw attention to the algorithmic mediation of information on the internet and its consequences:

> [...] the algorithmic mediation of information on the internet, which is responsible for deciding which information we will have access to and which will remain invisible, is operated according to the economic interests of the companies that control the platforms we visit on the internet, acting as an obstacle to the prospects of diversity and informational autonomy that are fundamental in free and democratic societies.

Some reflections involving contemporary Information Science, Knowledge Organization and classification, taxonomies and ontologies facing applications with the use of machine learning, the context of Archives and Libraries in digital environments and Information Ethics are some points that a future investigation may unfold showing the need for a regulation of the use of Artificial Intelligence that many countries have been discussing and adopting nationally and in their international relations.

Therefore, closely monitoring theoretical and applied research, the implementation of a data culture, the execution of Proofs of Concept (PoC) and projects involving Artificial Intelligence, Information Science and the Archives and Libraries context is a challenge that must be met continuously.

4 DEFINITION AND CHARACTERISTICS OF INFORMATION MANAGEMENT

Information is considered as a fundamental element for the decision-making process, the amount and the data from which it comes are an important resource that needs and should be managed. "Managing information is thus deciding what to do based on information and deciding what to do about information. It is to have the ability to select among the available information that which is relevant for a given decision." (ZORRINHO, 1995, p. 146).

According to Wilson (1989), information management is the effective management of all information resources relevant to the organisation, both internally generated resources and

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those produced externally. For information to be used effectively and to be considered valuable to the organisation it must possess the following characteristics (Chart 2):

Chart 2. Characteristics of information with value proposition

CHARACTERISTICS	DEFINITIONS
Accessible	The information must be easily accessible to authorised users so that they can obtain it in the right format and at the right time to meet their needs
Exact	Accurate information is error-free. In some cases, inaccurate information is generated because inaccurate data is put into the transformation process (this is commonly called rubbish in, rubbish out [GIGO])
Complete	Complete information contains all important factors. For example, an investment report that does not include all important costs is not complete.
Economic	Information should also be relatively cost-effective to produce. Decision-makers should always compare the value of information with the cost of producing it.
Flexibles	Flexible information can be used for a variety of purposes. For example, information on what stock of a particular part is available can be used by a sales representative to close a sale, by a production manager to determine whether inventory needs to be replenished, and by a financial executive to determine the total amount the company has invested in inventory.
Relevant	Relevant information is important to the decision maker. Information showing that timber prices will fall may not be relevant to a computer chip manufacturer.
Reliable	Reliable information is information that users can believe. In many cases, the reliability of information depends on the reliability of the method of data collection. In other cases, reliability depends on the source of the information. A rumour originating from an unknown source that oil prices may rise may not be reliable.
Secure	Information must be secured against access by unauthorised users.
Simple	Information should be simple, not overly complex. Sophisticated and detailed information may not be necessary. In fact, too much information can cause information overload, causing the decision-maker to have too much information, rendering him or her unable to determine what is really important.

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| Submitted on time	Information should be presented at exactly the right moment, when it is needed. Knowing last week's weather conditions will not help when you are trying to decide what clothes to wear today.
Verifiable	The information should be verifiable. This means you can check it to make sure it is correct, perhaps by checking many sources for the same information

Source: Reynolds and Stair (2011, p. 7).

To manage information, we can take advantage of the following approaches:

● Information Sciences and Libraries:

○ Information needs analysis (subject, context, perspective, applications, among others);
○ Characteristics of the information processing process (content analysis and synthesis involving indexing, classification, cataloguing and standardisation);
○ Objective tasks (application of selection criteria and access policies);
○ Process tasks (both intellectual and practical); e,
○ Technical, operational and ethical knowledge, skills and attitudes requirements.

● Database design (Data Mining);

● Information Resources Management:

○ Survey of information needs, obtaining and defining sources;
○ Collection - passive or active, knowledge of where to seek relevant information for the organization; data archiving; evaluation and analysis, verifying relevance, reliability and accuracy, an activity to be developed in a manner concerned with adding value to information; disclosure, prioritizing relevant information for each user. (MINETO; ORTOLANI, 2001).

Vieira (2014) proposes a cycle for information management that we will present in Figure 1 below, in the sequence we will make an appreciation of each of the stages of this cycle.

Figure 1. Information Management Cycle
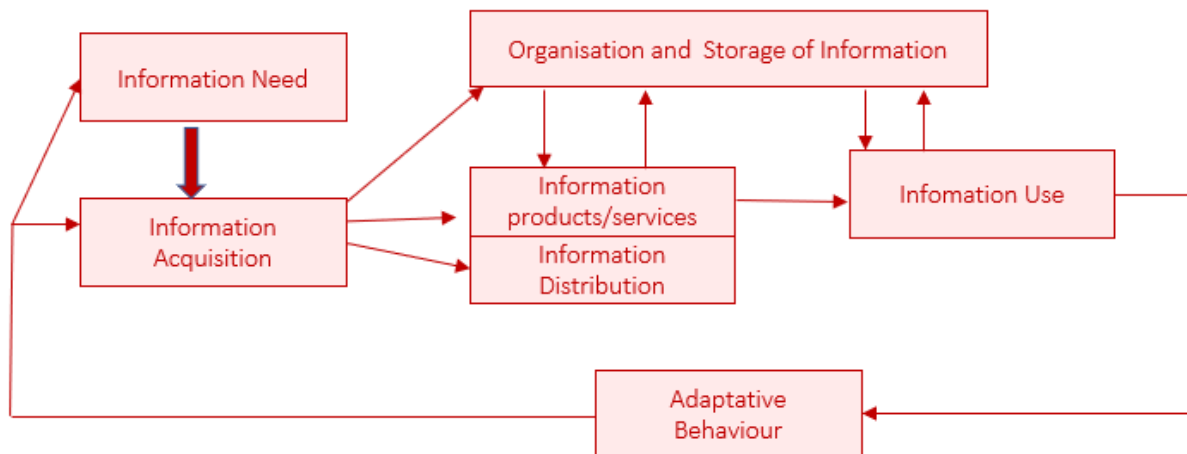
Source: Vieira (2014)

Need for information: The identification of the need for information is fundamental within an environment in extreme evolution, where the informational requirements change with great speed. The need for information is a dynamic variable that needs to be constantly updated in order to meet the needs for decision-making.

Information acquisition: Information acquisition should meet two demands: a wide range to meet needs and a selection capable of meeting the limitations of attention and cognitive capacity. The need for a wide range can be met by various digital sources of information as long as they have a verified source and it is necessary to delimit the scope of information according to the specific needs of each individual.

Organization and storage of information: Information is the organization memory, so the organization and storage process is relevant; it contributes to understand the processes, the past, the evolution and the future of an organization. According to Choo (2006, p.417), "[...] the way information is stored reflects how the organisation perceives and represents its environment". The information must be organized and stored so that it can be accessed and retrieved whenever necessary, and this demand is a function of the technology area that points out the best media and ways to store and preserve the information and the institution memory.

Information products and services: Products and services should meet the information needs for the development of individuals' activities. Information should contribute to add value to the activity and performance of users.

Information distribution: As Choo (2006, p. 414) states, "[...] the delivery of information should be done by means that conform to users' habits and preferences according to the following principle: 'the right information to the right person, in the right local format and at the right time'".

Use of information: The use of information by individuals happens from the moment they receive it, so it is important that the distribution is made in a judicious manner, considering the person who receives it, the moment in which it is received and how it is received so that it may be used at the correct time.

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5 IMPACT OF THE LGPD ON DIGITAL INFORMATION MANAGEMENT

The computerization of several sectors of society has allowed the creation and formalization of a lot of information. Within organizations we can generate data concerning production, sales, consumption, statistics, human resources and expenses, this considering only a few elements, more than this the evolution of the internet for the concept of internet 2.0 enabled all individuals who browse and use the internet began to create data and information.

The emergence of Web 2.0 is something that goes beyond the technological domain, it is more like a cultural revolution, the way people use the internet and interact with other individuals, with information and knowledge. With Web 2.0 we went from just consumers to content generators.

According to Tim O'Reilly (2006) Web 2.0 is "[...] the change to an internet as a platform, and an understanding of the rules to obtain success on this new platform". We realize, through this vision, that the internet is formed and structured through collective intelligence, i.e., it is the users themselves who make, modify, use and evaluate the content of this platform. Examples that may be mentioned within this concept are social media where the user and consumer is also a producer of information and knowledge.

Within the concept of information science we can say that this massive production of data is known as big data that led to a phenomenon called *datafication*. While big data evaluates a large number of data to obtain new information *datafication* consists of the idea of "[...] collecting information from everything that exists" (MAYER-SCHÖNBERGER; CUKIER, 2013, p. 10) or "[...] the electronic record of any phenomenon" (AMARAL, 2016, p. 10).

With data and information being elevated to the condition of an important asset for modern organisations, the personal life, intimacy and privacy of natural persons have not remained unscathed by the phenomena of big data and *datafication,* becoming, on the other hand, one of the main assets for treatment by public and private organisations.

In the digital age all our actions leave digital crumbs that can be exploited by organisations through the collection and manipulation of personal data, without any control by the data subject.

Seeking to strengthen the protection of personal information and transparency in how data is handled and stored, law No. 13,709, the General Law on Personal Data Protection (LGPD), was sanctioned by President Michel Temer in 2018. The LGPD aims to dispose of personal data in both physical and digital environments and recognises that in order for the individual to control the flow of their personal data, it is necessary to assign them rights in relation to those who are responsible for controlling this data. (FEIGELSON; SIQUEIRA, 2019, p. 120).

According to the 1st article of the LGPD, the recipient of the protection is the natural person against unlawful processing of their personal data by any natural or legal person, private or public. (COTS; OLIVEIRA, 2019, p. 42). As it is not the intention of this article to make an in-depth assessment of the LGPD, we will list some elements for our reflection regarding the impact of this legislation on digital curation.

➢ Any data that can identify a natural person or that can make this person identifiable shall be considered personal data.
➢ Anonymised data is excluded from the scope of the law (the anonymisation process cannot be reversed)
➢ Pseudo-anonymised data is not excluded from the scope of the laws (the anonymisation process can be reversed)
➢ Use of Information: To specify to the user the purpose of the collection of his/her data, in addition to being transparent about the treatment of this information and adopting measures that guarantee its security;
➢ Access to Information: Users should have easy access to the information being used whenever they wish, and may revoke their consent to data sharing at a later date without further difficulty;
➢ Ownership and Responsibility: The owner of the data is the person to whom the information refers. However, when the holder agrees to the use of his/her information, the company becomes responsible for its security and its processing;
➢ Handling of Information: Data processing should be terminated when the purpose specified above is achieved or when the information is no longer required or when the regulatory body requests it.

Digital curatorship must be attentive to these factors so that it is possible to carry out its role of selecting, organising, storing and retrieving the most diverse types of information without offending the legislation in force on the protection of personal data which may in some way identify the natural individual and which may in some way be accessible by someone other than the holder of the information himself.
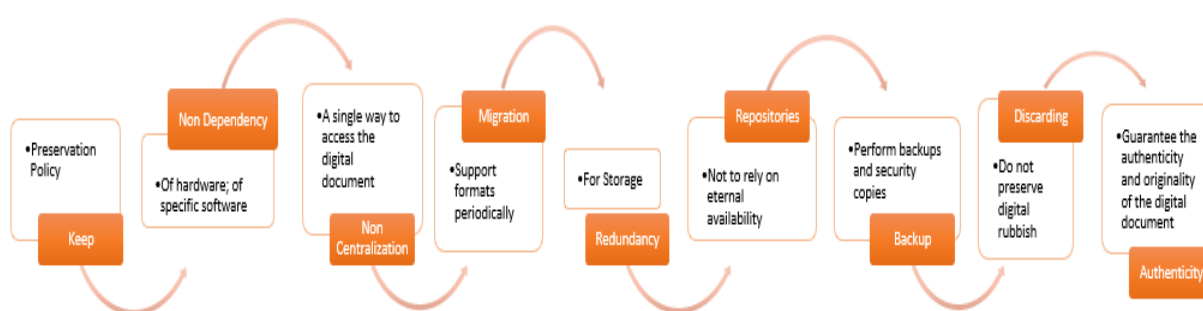
6 ASPECTS OF DIGITAL PRESERVATION

Digital preservation aims to make access to digital information available over time. A striking feature of our current world is the intangibility of information, today it is available and tomorrow? We cannot say with certainty that any given information will be available "forever".

There are many threats that "surround" electronic archival documents and this factor reveals the need to subject them to digital preservation. some of these threats are the obsolescence of formats, media and software (lack of support for old formats) and hardware; the occurrence of physical damage to hardware, which may translate into logical damage to information content; hardware and software failures; network failures; errors in communication channels; the modification of the physical conditions, conditioning, preservation of storage supports; the degradation of digital information, which is not related to the passage of time but to the fortuitous use of the computer, a virus, a breakdown, among others; natural factors: tornadoes, earthquakes, tsunamis, fires, floods; in the human factors which may translate into vandalism, accident or negligence; and in the organizational and economic failures; in the variety of formats (tabular data, spreadsheet, text, image, sound, video, interactive multimedia, among others), because it is more difficult the digital preservation of several formats, for having diversified contents and different obsolescence times. (ARELLANO, 2004; BARBEDO, 2010).

Another factor that directly impacts on digital preservation is the economic factor that determines the survival of digital repositories. It is very common to search for a particular publication and the journal or repository is no longer available for access because it no longer exists.

Figure 2. Commandments of digital preservation

Fonte: Innarelli (2016) – adapted by the authors.[1]

Digital preservation aims to make access to digital information available over time. A striking feature of our current world is the intangibility of information, today it is available and tomorrow? We cannot say for sure that a given information will be available "forever" and there are several reasons that may make this information unavailable, that is why these commandments are so necessary.

7 MANAGEMENT MODEL TO PRESERVE THIS INFORMATION

Some characteristics for the information management process, which first have a demand directed to the profile of the community for whom this management is being thought, the focus that the institution intends to achieve, the interest in partnerships, consortiums and cooperation. (RODRIGUES; BLATTMANN, 2014). But always observing the requirements of the legislation for copyright, administrative control that refers to who has access? and for what?

For the authors Rodrigues and Blattmann (2014, p.7) "[...] tacit knowledge and the information of informal character as vital for survival in increasingly competitive markets" this knowledge and this information come loaded with value and therefore its management with quality makes the difference for the results that the individual or institution wants to acquire.

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[1] Adapted: INNARELLI, H.C. Os dez mandamentos da preservação digital: uma brevíssima introdução, 2016.

The importance of constant monitoring of the demand should not be ignored, both the deadlines and the time of delivery of the information, what will be the place of access, whether it will be from any Internet connection or remote, the compatibility between the technical requirements (compatible hardware and software), the interface of easy handling for self-service and of course the possibility of constant interaction, thinking here of the flexibility and agility of information management.

8 FINAL CONSIDERATIONS

The information explosion that characterises contemporary society represents both opportunities and challenges for people, there is a quest to organise, retrieve and store this digital information. Information is both a financial and social asset - but how to manage, mediate and store this amount of information that is created so quickly? That is the question the curator attempts to answer!

What we can see is that the management of this digital information, which gets bigger and bigger every day, and also diversifies the storage formats, has shown the need for a constant search to improve, expand and disseminate new forms of management.

A major challenge to be overcome are the existing restrictions on digital preservation both in terms of technology, such as software obsolescence, file formats, availability and perpetuity of repositories. Another issue that must be considered is that of the PGPD data protection legislation, which imposes and regulates a series of rules for the retrieval, processing and use of personal information of natural persons.

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