

CHALLENGES IN INFORMATION MANAGEMENT IN THE DIGITAL AGE THE INFORMATION SCIENCE CONTEXT¹

DESAFIOS NA GESTÃO DA INFORMAÇÃO NA ERA DIGITAL O CONTEXTO DA CIÊNCIA DA INFORMAÇÃO

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ABSTRACT

This paper is an exploratory study to explore and analyze under the Information Science context how organizations are dealing with the complexities of the information professional global labor market. It presents a reflection on how the digital transformation is affecting organizations' innovation strategies and their information systems architecture. It also aims to study the complexities of the network society, whose new production configurations constitute the object of research for professionals from various fields, especially information workers, who deal with the challenges of information management in their different dimensions: scientific, technological, industrial, marketing, strategic and social.

Keywords: Information Management. Digital Age. Global Labor Market Complexities. Digital Transformation. Innovation. Information Science.

RESUMO

Estudo exploratório com objetivo de analisar, no contexto da Ciência da Informação, como as organizações lidam com as complexidades do mercado de trabalho global de profissionais da informação. Apresenta reflexões sobre a forma como a transformação digital tem influenciado as estratégias de inovação das organizações e a sua arquitetura de sistemas de informação. Visa também estudar as complexidades da sociedade da rede, cujas novas configurações de produção constituem objeto de investigação para profissionais de vários campos, especialmente os que atuam na gestão e organização da informação considerando as suas diferentes dimensões: científica, tecnológica, industrial, marketing, estratégica e social.

Palavras-chave: Gestão da Informação. Era Digital. Complexidade do Mercado de Trabalho Global. Transformação Digital. Inovação. Ciência da Informação.

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1 INTRODUCTION

A knowledge economy can be pointed as a reference to the cognitive and pedagogical models able to dialogue with the ever-changing world. Nowadays, intelligence has another meaning: it means to perceive things that had not been seen yet; it indicates an extensive and complex qualification. The ability of an organization to act on a global market depends on a competitive positioning as a creator and developer of technology-based products and solutions. In the coming years, emphasis should be given to technology-based entrepreneurship, that is, the ability to offer the market new products and services based on innovative technologies. This new configuration of the network society constitutes the object of study and research for professionals from various fields, especially information workers, who deal with the challenges of information management in their different dimensions: scientific, technological, industrial, marketing, strategic, and more recently, social. In this research, we perform a careful analysis of the challenges in information management and the complexities of the digital age.

2 THE COMPLEXITIES OF THE GLOBAL LABOR MARKET

The influence of science, information, and technology is evident in the organizations' abilities to compete globally. It is a challenge for current educational systems, in technological cooperation with the productive and services sector, to find ways to guarantee the proper qualification of human resources, offering not only technical but also humanistic and global training, so that modern information professionals become vectors for wealth production, income distribution, and sustainable economic development (MELO; MACHADO, 2018).

After almost two decades of the new millennium, the new paradigm for organizations relies on technological innovation, considering both social and economic applications. Technology is a decisive factor both in reinforcing the use of digital devices and in promoting wealth generation by offering new products, services, and processes, all of them heavily dependent on innovation.

Knowledge organization links three processes of strategic use of information: the creation of meaning, the construction of knowledge, and the making of decisions – a continuous cycle of learning and adaptation that can be named the knowledge cycle.

In recent years, the value of science, technology, and innovation has become strategically unquestionable. Advances in these fields act as the driving force of the industrialized countries, promoting the expansion of their wealth.

Scientific knowledge and access to technological innovations are very unevenly distributed between different countries, regions, social classes, age groups, educational levels, and so on. Thus, the issue of cultural diversity and studies about it should be included in theoretical considerations, empirical research, and policy planning in the field of information literacy development.

As the world becomes more complex, the skills required of information professionals, which were, at first, highly technical, come to encompass other responsibilities. It is necessary to think in a holistic qualification, enhancing management, methodological, cultural, multidisciplinary, and systemic skills. However, the role of technical skills should not be minimized.

3 THE DIGITAL TRANSFORMATION

Digital transformation requires a holistic view of business strategy. Adapting to the digital age requires businesses to upgrade their strategic mindset much more than their IT infrastructure. This truth is apparent in the changing roles of technology leadership within businesses. A Chief Information Officer's traditional role has been to use technology to optimize processes, reduce risks, and better run the existing business. But the emerging role of a Chief Digital Officer is much more strategic, focused on using technology to reimagine and reinvent the core business itself (ROGERS, 2016).

Digital technologies transform how we need to think about competition. More and more, we are competing not just with rival companies from within our industry but also with companies from outside our industry that are stealing customers away with their new digital offerings.

Digital technologies are also transforming the ways that businesses innovate. Traditionally, innovation was expensive, insular, and had high stakes. Testing new ideas were difficult and costly, so businesses relied on their managers to guess what to build into a product before launching it in the market. Today, digital technologies enable continuous testing and experimentation, processes that were inconceivable in the past. Prototypes can be built for pennies and ideas tested quickly with user communities. Constant learning and the rapid iteration of products, before and after their launch date, are becoming the norm.

In the digital age, the Information and Communication Technologies (ICTs) play an important and growing role. Industries and governments are getting increasing benefits from their continuous investments in ICTs, as well as from wider use of the Internet in a knowledge-based economy (OECD, 2017). ICTs have stimulated innovation in services, increased the efficiency of production and creation, and at the same time, facilitated the management of inventories and administrative costs. They were a

catalyst for changes in the computational environment, improving the organization of work, helping the enterprises to improve the quality and reduce the cost of their routine services.

ICTs, especially when associated with the rise of the level of skills and organizational change, apparently seem to support the improvement of productivity (PALETTA, 2014). Such benefits have long-term effects and will continue to develop, despite the difficulties and challenges which organizations are facing today.

4 INNOVATION IN THE INFORMATION SCIENCE CONTEXT

Many new applications of Information and Communication Technologies have a potential meaning and may have economic and social impacts, as well as a key role in the bonding and the convergence of the various technologies. Among these emerging technologies are the ubiquitous networks, which enable the monitoring of people and objects as well as tracing, storing, and processing of information in real-time.

Technology-induced change is a reality for all organizations competing in the industry 4.0. The key question in this competitive scenario is how the organizations are using technology to produce innovation in products, services, processes, and marketing.

One of the findings of this research was that we managed to point out several characteristics of the nature of the innovation process:

- New technology is often discovered by chance
- No matter how great the potential for solving a chronic problem is, there is usually resistance to the adoption and spread or diffusion of a new product and deliberate changes in the routine and organization structure need to implement this adoption
- Authority weights the change process.

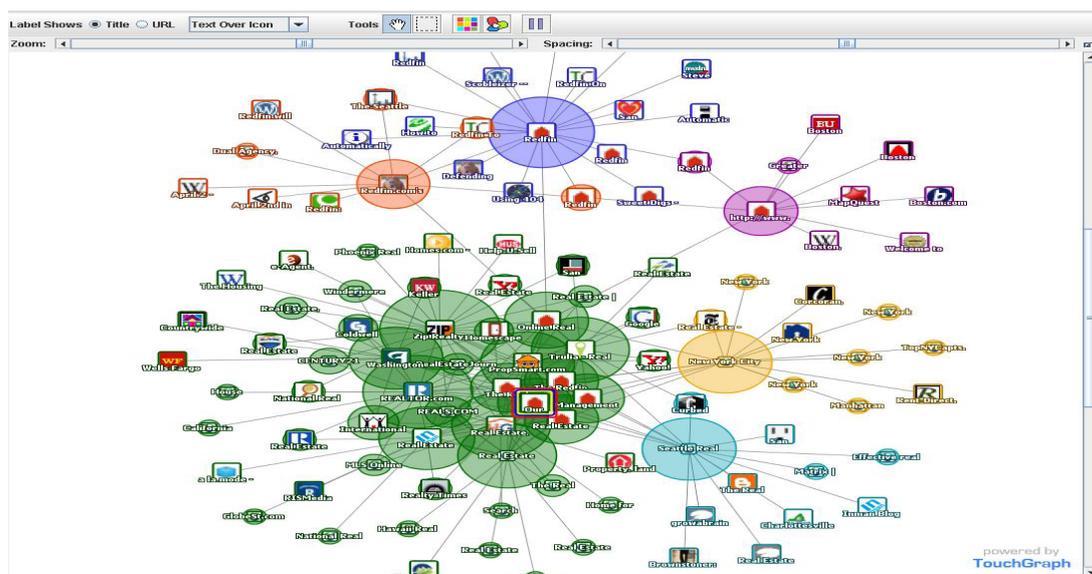
The information science is a social science that investigates the problems, themes and cases related to the perceptible and knowable information-communicational phenomenon through the confirmation or not of the properties inherent to the flow genesis, information organization and behavior: origin, collection, organization, storage, retrieval, interpretation, transmission, transformation and use of information (SILVA, 2006)

The notion that an innovation evolves from the germ of an idea into a concept and eventually sees the light of day as a commercialized or applied idea serves as a convenient way to organize the entire subject of technology management (ETTLIE, 2006).

Technological innovation is an essential tool to increase the productivity and competitiveness of organizations as well as to boost the economic development of regions and countries. Development does not derive from a mere growth of existing economic activities, but it resides fundamentally in a qualitative process of transformation of the productive structure to incorporate new products and processes and to add value to production through the intensification of the use of information and knowledge.

Innovation is increasingly recognized as being the result of the combination of different pieces of knowledge and expertise that exist within organizations, i.e., relationships may have interactive and complementary effects on technological innovation (MACHADO; DAVIM, 2020). Hence, it is not surprising that there has been a strong upsurge of various forms of inter-organizational collaborative ventures for innovation, Figure 1.

Figure 1 – Collaborative Innovation in Library and Information Science



Source: Autor

In the new global context defined by globalization and technological changes, knowledge has become the main wealth of nations, companies, and people, and may also be the main factor of inequality.

The Information Society is the cornerstone of Knowledge Societies. The concept of the “information society” is related to the idea of “technological innovation”, while the concept of “knowledge societies” includes a dimension of social, cultural, economic, political, and institutional transformation, as well as a more pluralistic stimulus for development. The concept of knowledge societies expresses

the complexity and dynamism of the changes that are taking place. The knowledge in question is not only important for economic growth but also to strengthen and develop all sectors of society.

5 COMPLEX NETWORKS AND INFORMATION SYSTEMS

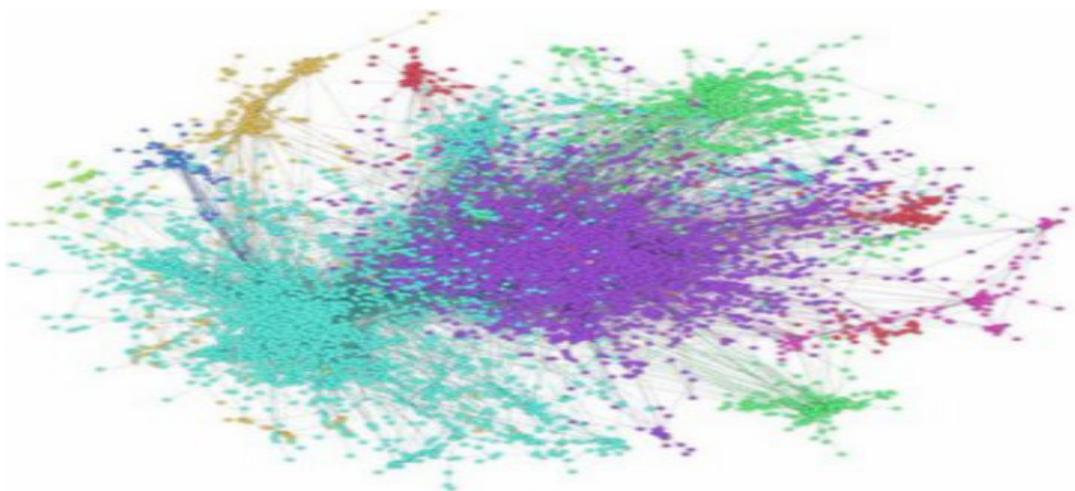
Complex information systems demand an efficient investment in Information Technology, which must yield tangible and sustainable results. The management of IT resources is essential to support the organization's digital strategy.

The alignment of IT with the overall strategy of the organization does not happen by accident. It requires full and active involvement from many levels and activities within the organization. It requires active and focused management. It is a continuous effort and requires world-class skills and expertise, either in-house or outsourced. It requires risk-taking, but with appropriate risk management. It also requires strong and demonstrable governance.

A complex information system (MILLS, 2018), is a large collection of interconnected components (Figure 2), whose interactions lead to macroscopic behaviors as in:

- Biological systems (e.g., slime molds, ant colonies, embryos)
- Physical systems (e.g., earthquakes, avalanches, forest fires)
- Social systems (e.g., transportation networks, cities, economies)
- Information systems (e.g., Internet and computer clouds)

Figure 2 - Internet Autonomous System Graph Circa 2001 - Image by Sandy Ressler

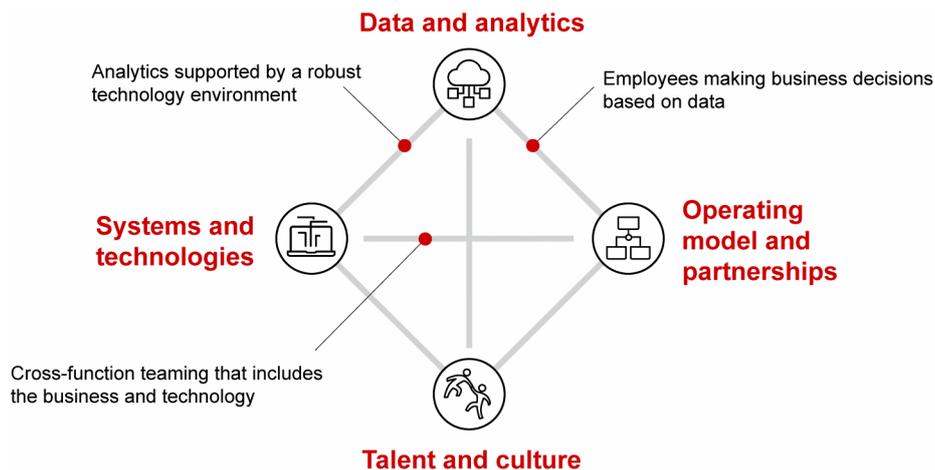


Source: [NIST](#)

Information Technology (IT) can be summarized as a set of all activities and solutions provided by computing resources and with applications related to several areas. Information Technology is also commonly used to denote the set of non-human resources dedicated to storing, processing, and communicating information as well as the manner how these resources are organized in a system capable of executing a set of tasks. IT is not limited to hardware, software, and data communications. There are technologies for the planning of computing, for the development of systems, for the support, for the software, for the processes of production and operation, and the support of hardware (PALETTA, 2014).

To survive in a complex and dynamic world, organizations need relevant, timely, and accurate information about their environment, Figure 3. Due to the increasing complexity and dynamics of their environment, organizations run into several difficulties in their efforts to structure the intelligence activities (VRIENS, 2004). Two particularly persistent problems are: determining the relevant environmental cues and making sense of the values of these cues.

Figure 3 – Information Treatment and Content Management approach – Bain & Company



Source: Bain & Company

Source: Bain & Company

The construction of a smarter Internet is moving in the direction of producing a revolution in the digital universe of the organization of information and knowledge. With the use of new technologies,

it is imperative to use Information and Communication Technologies to make the process of finding information and generating new knowledge more agile. It is at this point that a new user of information emerges with new demands for computational resources and new skills in producing new knowledge (CASTELLS; CARDOSO; 2005).

It is also important to highlight the eminence of new research and information treatment methodologies that allow the production of documents containing high added value info in less time (Figure 3). We need methodologies that can increasingly learn to reinvent themselves from interactions with customers and can bring to the process both the optimization of the perception of the demand for information and the decision-making context, as well as the political, economic, and social setting associated with such context.

In this scenario of real transformations, the social responsibility of information professionals grows, both as producers of knowledge in the scientific field and as facilitators in the communication of information to users who need it in society, regardless of the social spaces where they live and the roles they play in the productive system (FREIRE, 2010).

One of the greatest scientific challenges of the 21st century is how to master, organize, and extract useful knowledge from the overwhelming flow of information made available by today's data acquisition systems and computing resources.

6 RESULTS AND DISCUSSION

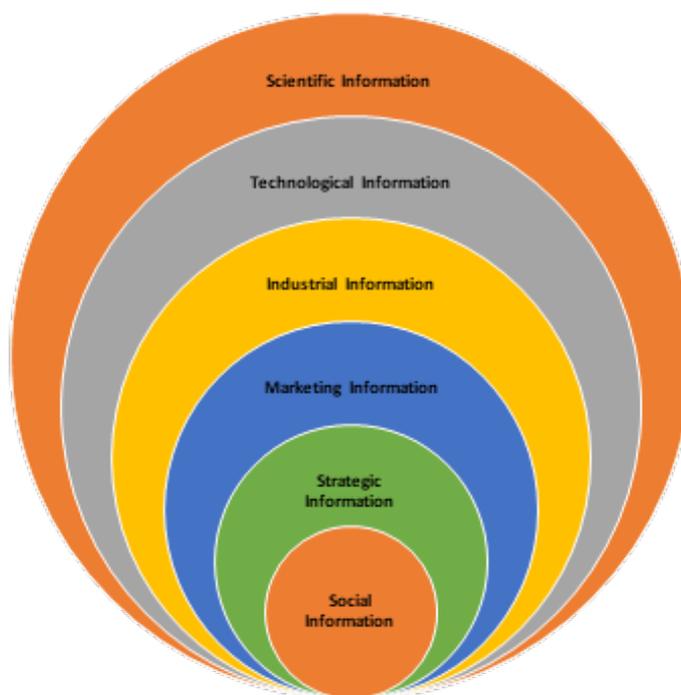
Continuous improvements in technology, networking, mobility, software, and hardware, including cloud computing, the Internet of Things, and information protection have made possible the development of advanced digital content. Greater cooperation is a major challenge since the production of digital content requires agreements between content developers, equipment manufacturers, and organizers of information.

The advent of rapid knowledge obsolescence also reflects the need for a professional with a holistic vision, management, methodological, cultural, and systemic skills. Global competitiveness requires a new profile for the information professional, who should be able to face the challenge of balancing the skills of a strong academic and technical background and the ability to manage production processes focusing on global competitiveness where information has strategic value in decision making.

Digital content has become a major driver in global organizations. Technological innovation and the new demands of information users are leading to new and direct ways of addressing creativity, methods of access, use, and appropriation of information.

The new configuration of the network society constitutes the object of study and research for professionals from various fields, especially information workers, who deal with the challenges of information management (Figure 4) in their scientific, technological, industrial, marketing, strategic and social dimensions.

Figure 4 – Information Complexity in The Digital Age



Source: – Research Project

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Considering the complex environment of the digital age, one of the main challenges of education in science and information technology is that we must develop a curriculum that supports an educational process aligned with the challenges of the global marketplace, at the same time considering the cultural and humanistic qualification of professionals that are working in the area, aiming for the making of leaders that can actively contribute to sustainable development and wealth generation.

In this context of increasingly dynamic changes, knowledge becomes obsolete quickly. In the case of complex networks, which are a cutting edge environment compared to many fields of scientific and technological knowledge, it is not unreasonable to suppose that half of what the students learn at university will be outdated in less than five years. It is recommended that we promote a holistic qualification, enhancing management, communication, leadership, methodological, cultural, multidisciplinary, and systemic skills – all of them highlighted in the knowledge society.

We need to understand and appreciate the complexity of the contemporary world to face the challenges of education. In addition to specific technical skills – indispensable in the complex network environment, most new or renewed professions will require the mastery of many cultural abilities. To educate the information professional for the twenty-first century is to balance the binomial expert (in its technical dimension) versus generalist (a multidisciplinary approach).

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