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Competitive Intelligence and Neuro-Technologies: The New Strategic Tools to Boost The Digital Economy

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ABSTRACT:
Purpose – *This paper aims to bridge the conceptual gap between the competitive intelligence domain and the current digital transformation and adaptation to the new values, norms, requests and expectations of Industry 4.0. Starting with the theoretical and chronological background attributed to the current developments, the following pages proceed to developing the argument that the Competitive Intelligence domain has become an imperative for the whole process of decision-making involved in Industry 4.0, applied to all businesses, disregard their status, domain, or turnover.*
Design/methodology/approach – *Adopting a multidisciplinary perspective, the paper uses both a theoretical and practical approach to the main concepts involved: Competitive Intelligence, neuro-technologies, Industry 4.0. While defining those central concepts and presenting the chronological evolution of the economic domain, it also provides examples of key tools and their application in the current Digital Era.*
Findings – *The current times are marked by a process of transition from digital transformation to digitization in almost all global businesses. The transition to digitalization affects the entire organizational ecosystem by integrating with digital solutions the value chain of global business. While the paper limits itself to setting the stage for future research, it still provides a valid range of theoretical knowledge and pragmatic applicability of the discussed concepts in the context of the current developing global reality.*
Originality/value – *Beyond the theoretical and chronological analysis, a valuable content of this paper is the discussion of innovative tools within the domain of competitive intelligence and neuro-technologies to enhance the adaptability to rapidly changing conditions, the agility in decision-making and the flexibility to redesign the existing strategies based on pertinent analysis of a great influx of information.*
KEYWORD:*: Business Strategy, Competitive Intelligence, Digital Economy, Industry 4.0, Neurotechnology, Resilience*

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I. INTRODUCTION

The world today witnesses a full technological and scientific development, passing through a digital age in which information is the raw material or the basis of knowledge. The easy access to information and the unprecedented development of various communication paths have also pushed for the economic sectors to adapt. The current times are marked by a process of transition from digital transformation to digitization in almost all global businesses. The transition to digitalization affects the entire organizational ecosystem by integrating with digital solutions the value chain of global business.

Adopting a multidisciplinary perspective, this paper aims to bridge the conceptual gap between the competitive intelligence domain and the current digital transformation and adaptation to the new values, norms, requests and expectations of Industry 4.0. Starting with the theoretical and chronological background attributed to the current developments, the following pages proceed to developing the argument that the Competitive Intelligence domain has become an imperative for the whole process of decision-making involved in Industry 4.0, applied to all businesses, disregard their status, domain or turnover.

Industry 4.0 is a relatively new concept that was introduced in 2011 in Hannover, during one of the largest trade shows in the world. Its inauguration represented, in other words, the start of the fourth industrial revolution. The first industrial revolution or Industry 1.0 took place between 1780-1870 and it was marked by the power of steam; the second industrial revolution or Industry 2.0 developed along with chain production and electrical power in the period of time between 1870 and 1950. From the year 1950 until 2010 was the third

industrial revolution which involved high levels of automation, digitization and IT. After 2010, our societies have witnessed the fourth industrial revolution. Industry 4.0 represents the smart industry that is characterized by concepts such as Internet of Things, Hyper connectivity, Cyber-Physical Systems or Big Data (Hitpass and Astudillo, 2019).

The key characteristics of Industry 4.0, in the current global context, push for the development of innovative tools to enhance the adaptability to rapidly changing conditions, the agility in decision-making and the flexibility to redesign the existing strategies based on pertinent analysis of a great influx of information.

II. LITERATURE REVIEW

2.1. Paving the road: from raw materials to digital assets

The sectors of the economy developed statically, in a geographically limited perspective until the beginning of the 1950s, when the society advanced to the third industrial revolution – Industry 3.0. The International Standard Industrial Classification (ISIC) was adopted by the UN (2008) in 1958 and had been revised several times, in 1968, 1989, 2002 and 2008. The three main economic sectors and their central activities are: (1) The primary sector represented by agriculture and natural resources; (2) The secondary sector represented by industry and construction; (3) The tertiary sector represented by trade and services.

Since the early 1960s, the three-model economic sectors have been criticized as too limited. Therefore, in 1961, Jean Gottman proposed for the first time the division of the tertiary sector by subdividing it into tertiary and quaternary sectors. In 1969, Dean (1969) suggested adding a new sector of the economy, the quinary sector. As a result, the late 1960s brought together a new discussion in the field: the "Q-Sectors" of the economy – the Quaternary and Quinary economic sectors. In 1961, Gottmann described the "quaternary occupations" as those providing services that require research, such as "analysis, judgment, briefly, brain and responsibility" (Gottmann, 1961) and "what might be called the quaternary forms of economic activity; managerial and artistic functions, government, education, research, and brokerage of all kinds of goods, services and securities" (Gottmann, 1961).

In this context, one of the major socio-economic transformations of the information age started in the 1970s with the rapid development of communications technologies. In 1977, Abler, Adams and Gould expanded the scope of the quaternary sector to "information activities". Abeler and Adams (1977) pointed out that information production and service activities should be regarded as quaternary rather than secondary or tertiary sector. This approach creates a completely different classification system in which information is used for both production, transaction, and consumption. It is also selected as a separate sector, consisting of channel goods and information itself. The rapid development of this sector and its dominance in developed economies requires its separate study, although its increasing interrelationships with all other sectors make it difficult to completely separate it (Kellerman, 1985).

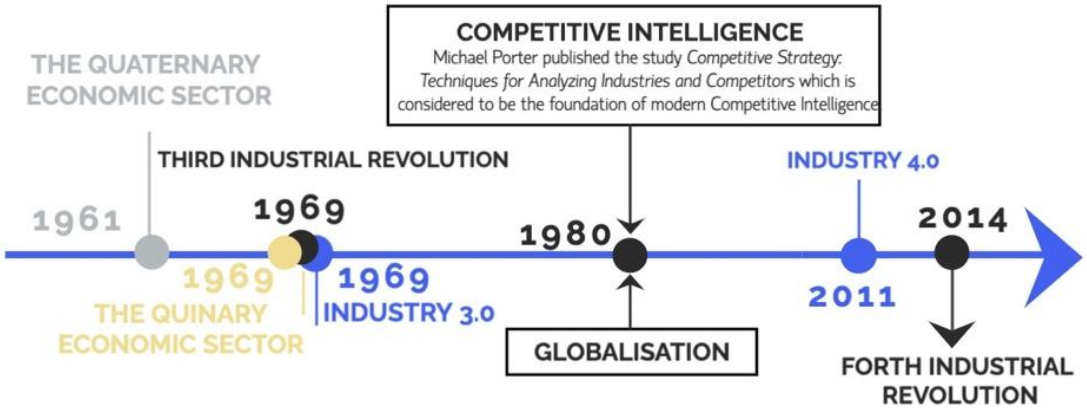
Abler (1977) and Adams (1977) defined the quinary sector as consisting of establishments that engage in control activities, the production and processing of information and non-routine decision making. Government is the main quinary industry, but it exists both in the private sector, through administration corporations, and in the voluntary sector, through NGOs and Think-Thanks.

If by the mid- '80s, the tertiary sector represented by trade and services was an extremely important element in understanding "the future, as well as the present, regarding the economic geography of different countries, as well as land use, distribution and location of people and their activities" (Gottman, 1983), since the 1990s, the expansion of the Internet and the development of the IT&C have provided a valuable change of paradigm. An important step occurred together with the migration from analog to digital technologies that allowed the exponential development of transfer rate and volume of information. The difference between analog and digital technologies is that, in analog technology, the information is translated into electrical impulses of different amplitude.

Digital technologies allow the improvement of traditional products and business models, but especially the development of completely new digital products and business models. The characteristics of digital technologies suggest similarities in new trends in innovation in sectors, similar to other general-purpose technologies (GPTs) of the past, such as steam engine, electricity and internet (David, 1990; Bresnahan and Trajtenberg, 1995). While end products in primary sectors such as food or mining are unchanged, the media, music and gambling industry, to name a few, have completely changed its offer in recent decades. Similarly, while the automotive sector has automated important parts of its production processes, others such as agriculture are less advanced (Paunov and Planes-Satorra, 2019). These represents opportunities for further research.

Today, although the final products in the primary sectors have remained unchanged, the development of digital technologies created the need for adaptability and flexibility, proved by the emergence of new products and industries based on information and knowledge that are included in new economic sectors, the "Q sectors" of the economy: the Quaternary and Quinary economic sectors.

Figure 1:Chronology of The Q Sectors, Competitive Intelligence, and Industry 4.0



Source: own data and interpretation

III. RESEARCH METHODOLOGY

This study is a research with mixed methods that incorporates both quantitative and quantitative methods of data collection. This type of study allows a researcher to understand complex phenomena qualitatively, as well as to explain phenomena through numbers, graphs and basic statistical analysis. The study is an explanatory research that uses the historical review method to collect data related to the field of Competitive Intelligence in the Information Society. This choice was made to increase the consistency and reliability of the multiple case study and the quality of the data. Multiple data collection methods really ensure data triangulation and provide a stronger foundation of the main constructs and results (Eisenhardt, 1989).

Exploratory research is often conducted in new areas of investigation, where the objectives of research are: to discover the magnitude or magnitude of a particular phenomenon, problem or behavior, to generate some initial ideas (or suspicions) about that phenomenon. , or to test the feasibility of undertaking a larger study of the phenomenon.

This study is a research with mixed methods that incorporates both quantitative and quantitative methods of data collection. This type of study allows a researcher to understand complex phenomena qualitatively, as well as to explain phenomena through numbers, graphs and basic statistical analysis.

When using the historical review method, the task of the researcher is to describe what happened in the past, so that he can understand the present or the future. This method involves going through existing records and reports to get a more accurate picture of the phenomenon. The archives are reviewed in an interrogative manner, following a specific research question or problem. The main problem in using such a method is the possibility of collecting inaccurate or flawed data due to the human factor. It is important that when using this method, the data is verified from several sources, and the researcher's attitude is critical and compares different explanations of the situation or event.

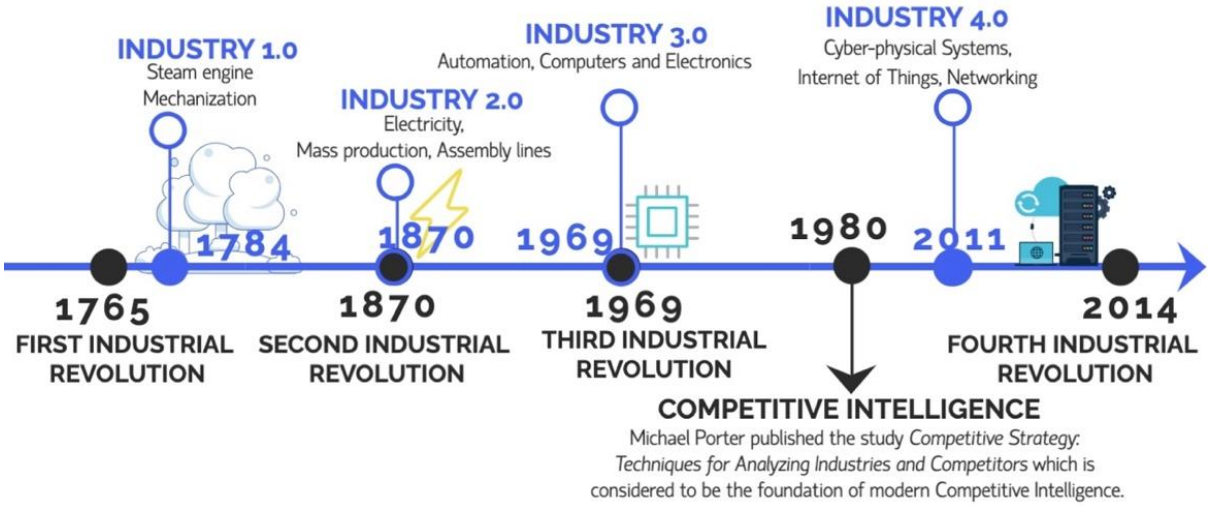
IV. RESULT AND DISCUSSION

4.1. Competitive Intelligence vs. Industry 4.0: the macro- and micro-perspectives

Industry 4.0 has the main purpose of creating digital production enterprises which, besides being interconnected, they communicate, analyze, and use information in order to drive intelligent actions back into the physical world. It leads the physical act of design, manufacture, distribution, and performance in a continuous cycle with real-time access to data and information that depends on the exchange of information between the physical and digital worlds. But the essence of Industry 4.0 is actually the leap from digital technologies connected back to action in the physical world.

In the same line, Competitive Intelligence is a process that involves the collection, processing, analysis and use of information regarding the environment in which the company operates (Adidam et al., 2012) and aims to transform this information into valuable intelligence (Kim et al., 2015). The expansion of the Competitive Intelligence field in the last decades has started from the need for technological improvements, the reduction of costs and the alignment of the business strategy with the competitive environment (Fleisher, 2004).

Figure 1:Competitive Intelligence and Industrial Revolutions' Chronology



Source: own data and interpretation

4.2. The macro-perspective: The impact of the Competitive Intelligence Function in the Industry 4.0

The Competitive Intelligence function is a business tool that supports organizations enabling them to increase business performance by improving their knowledge, internal communications and quality strategic plans (Rezaie et al., 2011). In addition, due to the formal and systematic development of Competitive Intelligence, managers are able to make better informed decisions about future events (Dishman and Calof, 2008).

The impact of the Competitive Intelligence function on organizations within Industry 4.0 is significant because at the organizations level it enables decision makers to detect new opportunities, create value and improve performance (Salguero, 2019). It also gains significance as a process that allows companies to have an advantage in the market - sustainable competitiveness (Hill and Jones, 2009). Also, the Competitive Intelligence function allows managers to understand the competitive forces in order to adapt their strategies to the rapidly changing industry and to develop sustainably (Trong, 2017).

In order to increase the efficiency of operations in the global corporate market and to create the competitive advantage in the era of Industry 4.0, enterprises must begin to identify, recognize and gradually meet the requirements of the current local and global context. The first step in this process should be to understand the specifics and needs of the Age of Industry 4.0. Among these needs, where the function of Competitive Intelligence can have a significant impact on global companies, one can identify:

o Assessing current needs: to determine when and where automation can help with Industry 4.0 and where it can be worth the wait. The Competitive Intelligence can help managers consider what technologies are already available to significantly reduce costs and risks and what investments might be worth waiting for later, when technological advances can lead to significant upgrades to current capabilities.

o Develop a talent strategy to meet the new talent needs created by the technologies based on Industry 4.0: Competitive Intelligence can help decision-makers continually evaluate the evolving needs of the organization to proactively prepare for the talent needs that may exist in the future, especially those focused on maintaining and managing the assets activated by Industry 4.0 (Vasquez et al., 2016).

o Monitoring emerging trends: Competitive Intelligence allows managers to make efficient planning and decision-making in an area that is evolving rapidly over the next decade. The Competitive Intelligence function can examine new opportunities to improve distribution operations by gathering competitive information for benchmark performance and monitoring potential market threats.

o The planning, management, reliability, and security of data in an increasingly complex system: Data management systems are a major part of the implementation and operation of Industry 4.0 technologies and should be considered critical to the success of the effort. The ability of management to implement a Competitive Intelligence function within the company to collect, analyze, and protect information is essential to the success of a global business in Industry 4.0.

In the context of Industry 4.0, the competitive environment has become more volatile, uncertain, complex, and ambiguous and the function of Competitive Intelligence has become a necessity. Industry 4.0 refers primarily to digital transformation which allows organizations to create and innovate their products, services and processes, whose differentials will be essential to remaining on the marketplace. Digital technologies generate a large amount of data but creating value resulting from the use of data requires further investigation (Bordeleau et al., 2018). In order to improve the decision-making process and to better orient the

business strategy, the managers and especially the decision makers involved in this Industry 4.0 must know how to access, evaluate and intelligently use data, information and intelligence in the Competitive Intelligence process (Ottonicar and Mosconi, 2018).

All information indicates that the benefits created in the era of Industry 4.0 will be not only intangible, but temporary, quickly "outdated" competitors. Industry 4.0 will be more of a "system" of highly technological and organizationally advanced competitive advantages than a clearly identifiable single activity that distinguishes a particular company (Adamik and Nowicki, 2018).

It is essential for business leaders to proactively evaluate the impact of trends along with the potential benefits of using Industry 4.0 technologies, as this can allow managers to plan effectively to meet future business goals in all areas that will change radically and quickly in the next decade.

4.3. The micro-perspective: The Convergence of Neuroscience and Digital Technologies for practicum in the Competitive Intelligence domain

The early period of Competitive Intelligence – the 80's – was the pre-internet period and was characterized mostly by analogue systems. Most of the data and information were gathered from primary sources. The data and information that were collected from secondary sources needed the intervention of the human factor to process, analyze and extract meaning from them. As technology evolved, most of today's data and information is generated and stored in digital format - this period known as Digital Age. Digitization is a process that generates a huge amount of data that cannot be analyzed in real-time by human users. This context has led to the accelerated development of solutions that process and analyses a huge volume of data that bears the generic name of "cognitive solutions". "Cognitization" was a logical step in the digitization advancement and expansion of gobbling. IBM's Cognitive Business (IBM, 2015), as an application of the Watson platform, revolutionizes how to obtain, analyze, store and use digital information for economic and financial decisions. The Microsoft Brainwave (Microsoft, 2017) project promises access to real-time artificial intelligence (AI) services, especially in the financial and research environment. Immersive cognitive systems allow corporations to lead from a veritable "cockpit" or "bridge" with situational assessment rooms, cognitive boardrooms, immersive classes etc. in which human staff will constantly interact with artificial cognitive agents. For smaller businesses (national, regional), it is estimated that in the coming years, access to AI services over the internet (Internet-Deliver AI) will be the standard for the civil business domain (Martialay, 2015).

In the field of Competitive Intelligence, the goal of practitioners is to collect data and information that they process and analyze, then transform them into intelligence suggesting actions, strategies or decisions. To respond rapidly to the urgent need to collect relevant data and information from an increasingly volatile, uncertain, complex and ambiguous environment, as characterized by the current economy, Competitive Intelligence practitioners need to build fast and efficient work systems such as those described above. At the same time, they need to develop new skills, such as agility and attention. Attention is a mandatory condition for Competitive Intelligence practitioners while agility often depends on the ability to maintain a high level of attention (focus) and at the same time the rapid response to the stimulus (alertness). The ability of analysts to remain focused on a particular goal is what ensures their success or failure.

For the Intelligence Competitive practitioner to remain relevant, efficient and to keep up with an environment that contains a large volume of information, while the field of Artificial Intelligence develops, it needs to enhance his cognitive abilities through optimization, stimulation and augmentation. Among these three methods, the one that represents the subject of this paper is augmentation.

Augmentation implies enhancing the cognitive abilities within while optimizing and stimulating the factors of intervention. For optimization, intervention can be done through pharmacological means such as nootropic drugs or smart drugs. Stimulation can be obtained through neuro-technology: electrical and magnetic transcranial stimulation. Another way to classify brain stimulation methods is to divide them into two broad categories: invasive methods and non- invasive methods. Invasive methods involve direct brain intervention such as Deep Brain Stimulation (DBS) and have been used for learning enhancement (Clark and Parasuraman, 2014; Suthana and Fried, 2014). The most popular non-invasive brain-stimulation technologies are transcranial electrical stimulation (TES), transcranial magnetic stimulation (TMS), and focused ultrasound (FUS). While the three of them - optimization, stimulation, augmentation - are means of brain enhancement, augmentation is non-invasive, risk- free and it is the only one that is based on neuroplasticity - which means the ability of the brain to learn new things. Much recent research (Edmonds and Tenenbaum, 2012) has led to amazing understandings about the relationship between pleasure, learning and motivation in the brain. It is now known that there is a centre of pleasure in the medial part of the prefrontal cortex, right in the middle of the forehead, a part that is involved in the process of focus attention, alertness, learning and that motivates us to go forward.

Pleasure and happiness are the basic motivators for our lives. We want to expand happiness and pleasure develops momentum. We learn to associate many types of events with these feelings. Living in a sense of happiness, we change our vision of life, the reaction to events and situations, our memory, our learning and

our general well-being. When we are happy, we connect much more easily to others. As we know, the maintenance of positive emotions stimulates health while maintenance of the negative benefits of the disease.

Mental training is based on biofeedback - it is a method that uses the mind to control a function of the body that is normally regulated automatically, such as body temperature, heart rate, happiness and pleasure etc. to increase the production of high-frequency (gamma) brainwaves from the medial part of the prefrontal cortex. In short, people can teach their brains how to raise their attention, alertness happiness and other positive feelings that are associated with the production of chemicals (endorphins and dopamine). Based on a device that measures the frequency of brain waves and software that interprets this information, we can tell when the brain (based on the fact that certain activities and certain states are associated with certain types of waves) is concentrated when it secretes dopamine when it is happy and other. This type of training is called neuro-feedback.

Advances in neuroscience and the development of neuro-technologies have progressively raised new and unique ethical issues ("neuroethics"), in addition to the more traditional aspects related to human participation in research studies.

The most important ethical issues are related to: • Mind Reading and Privacy; •Agency, Responsibility and Liability; • Safety and Invasiveness of Brain Enhancement; •Society.

V. CONCLUSION

The digital era is in full development and pushes for drastic changes in all spheres of our lives and, at the same time, in all branches of our societies. In this regard, while keeping an eye on the current Industry 4.0 advancements, together with the newly contoured economic sectors, this paper brought to the table a valuable conversation about the emerging competitive intelligence and neurotechnology tools that can support the evolution and adaptation to the new world.

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