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DIGITAL ECONOMY: LABOR SHORTAGE IN TECHNOLOGY OF INFORMATION

DIGITAL ECONOMY: SCARCITY OF LABOR IN INFORMATION TECHNOLOGY

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Summary

This article presents a study on the digital economy in which there is a shortage of labor for professionals who work with Information Technology in Brazil. In the desire to understand this economic and social phenomenon that presents itself as other challenges within the context of organizations that need to articulate themselves in an economy that makes use and application of new technologies not only in their internal processes, as well as making use of technology as a basis to develop new technology-based products and services to deliver to a rapidly expanding market. With the advent of the pandemic caused by Covid19 in 2020, numerous companies and organizations migrated from analogue to digital. This change implied reorganizing plans and reorganizing the articulations of their respective businesses so that it was possible to survive within a chaotic and unpredictable scenario that the pandemic caused in all sectors of the economy and consequently in organizations. This exodus from analogue to digital takes place in a context of rapid expansion in the information technology sector, which has seen new digital information and knowledge technologies emerge in all existing dimensions. Using a qualitative methodology for observing the social phenomenon, it sought to answer burning questions that permeate the circumscribed universe of administrators and managers, so that a better understanding of the social fact was possible, as well as understanding the new perspectives and trends regarding new digital technologies. of information and knowledge. **Key words:**Scarcity. Technology. Labor. Economy. Digital

Abstract

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This article presents a study on the digital economy in which there is a shortage of labor for professionals working with Information Technology in Brazil. In the eagerness to understand this economic and social phenomenon that presents itself as other challenges within the context of organizations that need to articulate themselves in an economy that makes use and application of new technologies not only in their internal processes, as well as making use of technology as a basis to develop new technology-based products and services to deliver to a booming market. With the advent of the pandemic caused by Covid19 in 2020, many companies and organizations migrated from analog to digital. This change implied reorganizing plans and also reorganizing the articulations of their respective businesses so that it would be possible to survive within a chaotic and unpredictable scenario that the pandemic provoked in all sectors of the economy and, consequently, in organizations. This exodus from analog to digital takes place in a context of the expansion of the information technology sector, which has seen the new digital technologies of information and knowledge emerge in all existing dimensions. Using a qualitative methodology of observation of the social phenomenon, it sought to answer nagging questions that permeate the circumscribed universe of administrators and managers, so that a better understanding of the social fact was possible, as well as understanding the new perspectives and trends regarding new digital technologies information and knowledge.
Keywords: Scarcity. Technology. Labor. Economy. Digital

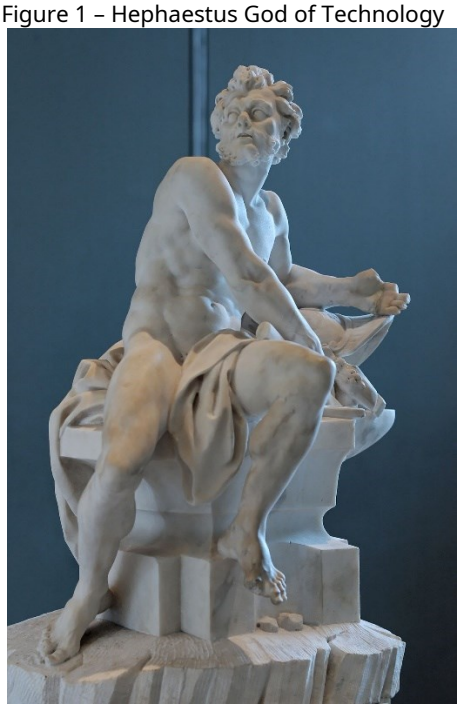
1. Introduction

In Greek mythology Hephaestus, son of Zeus and rejected by his mother, the Goddess Era, developed immeasurable skills and competencies in the area of metallurgy; using volcano larvae he created the most powerful weapons and the most beautiful jewelry. Hephaestus, the rejected and skilled artist, is the mythological inspiration that represents the god of fire and metallurgy who has dominion over technologies and the creator of the weapons of many of the Olympian gods.

The representation of Hephaestus in the collective imagination considering his leading role in the titanomachy[3]. In effect, this protagonism over time always makes a modern allusion to the skills and competencies related to new digital information and knowledge technologies (TDICs).

[3]A **Titanomachy**, at Greek mythology, was the war between the Titans, led by Kronos, against the olympic gods, led by Zeus, which would define the domain of the universe. Zeus managed to defeat Cronos after rescuing his brothers after a fight that lasted ten years

Figure 1 – Hephaestus God of Technology



Source: Pexels – image bank

With a leap from ancient Greece to the present day in which these new technologies present themselves as proposals for disruption by imposing new challenges on administrators, a brief digression is necessary to understand what is intended to be investigated.

From the beginning of the 1990s to the present day, digital information and communication technologies (TDICs) have revolutionized the world and promoted drastic changes in the management environment of companies and organizations.

Algorithms, artificial intelligence, Big Data, augmented reality and machine learning are increasingly present within the business context.

With markets increasingly heated due to the use of the internet for commercial transactions, added to the access and use of technologies that provide access to the internet (Smartphones, tablets, notebooks, computers). In this sense, Schwab (2016 p.28) advises us:

> Until recently, the use of robots was confined to tightly controlled tasks in specific industries; automotive, for example. Today, however, robots are increasingly used in all sectors and for a wide range of tasks, whether in precision agriculture or nursing. Soon, the rapid progress of robotics will make collaboration between humans and machines an everyday reality. Furthermore, because of other technological advances, robots are becoming more adaptable and flexible, as their structural and functional design is inspired by complex biological structures (an extension of a process called biomimicry, in which robots imitate patterns and strategies of nature.

In this short space of time in which these new technologies emerge and become pervasive and permeate all spaces of people's contemporary lives. As Pierré Lévy had advocated in his seminal work Cybecultura "This type of communication device can be used for games, learning or work environments, urban prefigurations, combat simulations, etc. The fact is that this digital transformation has also brought some complications for managers in terms of attracting and retaining qualified labor to work with information technology (IT). There is a growth in the supply of jobs for the Information Technology sector and in the same proportion a lack of professional qualifications at all levels (operational, technical and with higher education specialization) in Brazil.

Growing and exponential demands to meet market requirements through the use and application of new technologies in the circumscribed universe of business, increasingly require qualified labor prepared to innovate and in a disruptive way create and develop products and services for an exponential world from the starting point of information and knowledge technologies.

Therefore, managers of contemporary organizations need to work together to try to attract and retain labor that has skills and abilities to work with the use and application of new digital technologies. Current circumstances require skills and competencies that go beyond using new digital technologies restricted only to operational actions within organizations. Just like in the abyss of Charles Percy Snow (1959) in "The Two Cultures", the science of hiring and the humanities are faced with disturbing and heartbreaking questions. The questions we propose to investigate in this work are:

- Why is there an increase in job offers for IT professionals?
- What are the actions of managers and organizations to attract and retain IT talent?
- What does the digital economy signal to the market in terms of hiring professionals who work with the development of TDICs?

In the desire to understand this economic, social and contemporary phenomenon, qualitative methodology was used, based on the observation of contemporary social and economic facts.

As Minayo argues:

Qualitative research answers very particular questions. It is concerned, in the social sciences, with a level of reality that cannot be quantified. In other words, it works with the universe of meanings, motives, aspirations, beliefs, values and attitudes, which corresponds to a deeper space of relationships, processes and phenomena that cannot be reduced to the operationalization of variables. (MINAYO, 2001, p. 22).

However, analysis of the current context of organizations was used, as well as bibliographical references that deal with and discuss the topic.

2. Theoretical Framework

The digital economy is currently experiencing its technological version of the Titanomachy. Just like the infamous war of the titans that was led by Cronos, companies in a general and unrestricted way are fighting to survive in the post-pandemic world caused by covid-19. The pandemic that emerged in 2020 accelerated processes that were anchored by new digital information and knowledge technologies (TDICs) that were previously stationary, or even in gestation with regard to the use and application of these TDICs, no longer as mere operational objectives, but above all with a leading role in finding new businesses or even leveraging projects of innovation and disruption.

With the advent of the pandemic, there was a gigantic exodus of people and companies that moved not only to the internet, but also new start-ups emerged.[4] technology-based companies that operate at different levels within the company ecosystem. Even in the face of a scenario of instability for numerous sectors of the economy arising from social isolation and the inherent uncertainties arising from the cause of the pandemic, it also required companies to accelerate their digital transformation processes, such that knowledge and skills in new technologies Digital technology became a top priority.

Without obstacles, BigTechs (companies that are considered giants such as Apple, Amazon, Microsoft and Google) surfed the crest of the wave and also invested massively in expanding their range of operations in their respective niches and investing in new projects that were anchored in information Technology.

[4]According to SEBRAE, a start-up can be defined as a group of people starting a company, working with a different, scalable idea and in conditions of extreme uncertainty.

In this direction and sense, transacting based on new technologies is no longer a trend but a necessity for adaptation and survival of organizations regardless of their size or radius of operation. Speed and agility in this process drives the new dynamics, and has removed countless managers from their respective comfort zones and their natural inertia.

Managers must now have a better understanding of the current digital economy in terms of the skills and competencies of employees who work directly with digital information and knowledge technologies (TDICs), given that technology has always represented an asset and even impacting the political, social and economic dimensions within companies. More than before, these skills and competencies figure within the purposes and planning for strategy and competitive advantage of organizations.

At the climax of the pandemic, the relevance of convergence between the need to adapt technologically of companies and the inevitable oxygenation of intellectual capital (at the level and dimensions of TDICs) endogenously in organizations caused an explosion of new possibilities, and with effect new jobs related to new technologies emerged on exponential scales.

Estudio NSC Total news in March 2021 reported that:

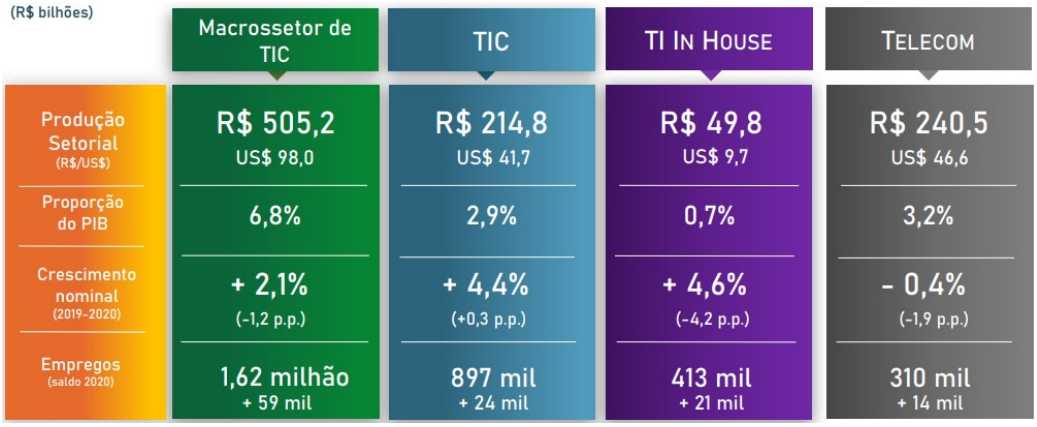
A survey carried out by GeekHunter, a consulting startup, a reference in recruiting IT professionals, showed that the total number of vacancies open in the information technology sector in 2020 increased by 310%. And, according to data from the World Bank, by 2024 there will be the creation of approximately 420 thousand new jobs in the area. These are very impressive numbers, even more so if we take into account the economic crisis we are going through and the high unemployment rate.

The two macro areas that most demand professionals linked to information technology were health and education, according to the WW COVID-19 Impact on IT Spending Survey5.

The technology sector is booming and has the prospect of exponential growth estimated at around billions, according to the report by the Brazilian Association of Information and Communication Technology (BRASCOM).

5Source:COVID-19 Impact on IT Spending Survey: The Impact of COVID-19 on Security Spending expected varies depending on market vertical and business size (idc.com)

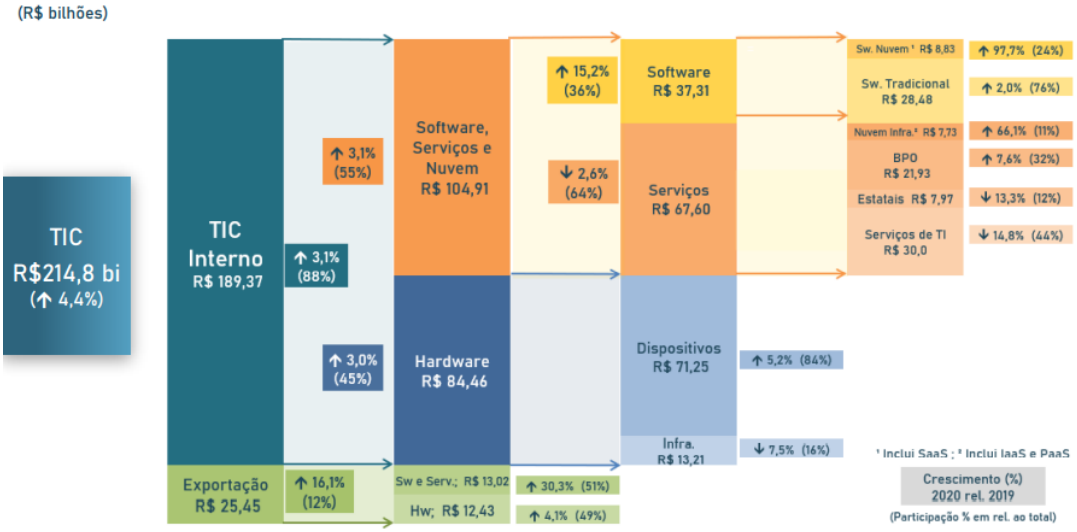
Figure 2 - Production and growth of ICT and IT subsectors In House 2020 - BRASCOM



Source: BRASCOM, 2021.

The graph above shows the growth of the information technology sector even within a chaotic economic and social scenario and uncertainty in which companies were inserted and in which their administrators need to consider quick responses for the survival of organizations. It is important to highlight that in the web of information technology, other subsectors (hardware, software and services) in addition to deoxidizing internal processes also tend to reinvigorate plans that are directed towards a digital economy for companies and their managers. This can be understood with the graph below that shows the scalar growth of software, cloud services as well as hardware and infrastructure in information technology in 2020 compared to the same period in 2019.

Figure 3 - Production and growth of the ICT and In-House IT Subsectors in 2020 - BRASCOM



Source: BRASCOM, 2021.

With a global dynamic heading towards a latent digital economy in which organizations, in addition to investing in infrastructure in new technologies, also created new products and services, invested in marketing restructuring and with consequent changes in sales forces and *marketplace* digital platforms and also expanded their prospecting and relationship platforms with internal and external customers, all within a period of time with a high degree of uncertainty and increasingly restrictive budgets.

In this line of reasoning, according to the report by Sena and Granato (2021) and which reported that the consultancy Michael Page in the person of its Information Technology manager Luana Castro:

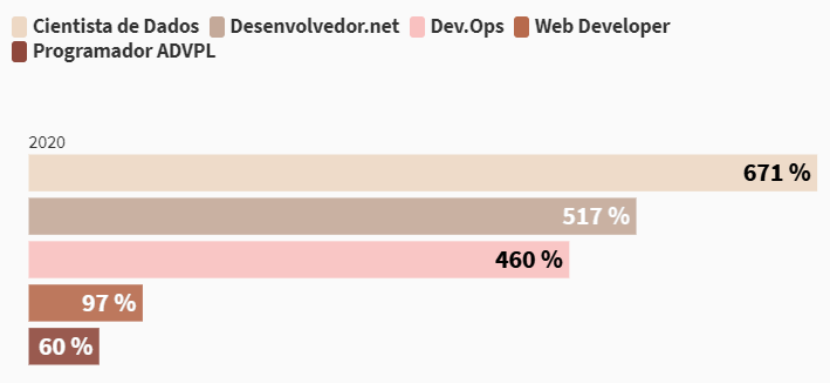
"The high demand for technology professionals is global, it is not just a Brazilian issue. The pandemic accelerated it even further. There was an increase in the digitalization of companies, which created products, invested in online sales, platform sales, etc."

Brazil is a country that stands out on the world stage not only as an industrialized country, but above all as an integral part of the great web of information technology. In fact, this country of continental dimensions also feels the impacts of the shortage of qualified labor for the respective sector. With social issues still unresolved in Brazil and affecting the country's economy, such as the issue of quality of education, which often

it is always decreasing in international comparison, coupled with the low level of English language proficiency among the population.

Therefore, traditional education cannot deliver the number of Information Technology professionals in the quantity and quality demanded by companies and organizations. The growth in the number of vacancies in the sector can be understood through the study that the recruitment and selection company Catho made available only in the city of São Paulo, which is part of a pulsating point on the world stage:

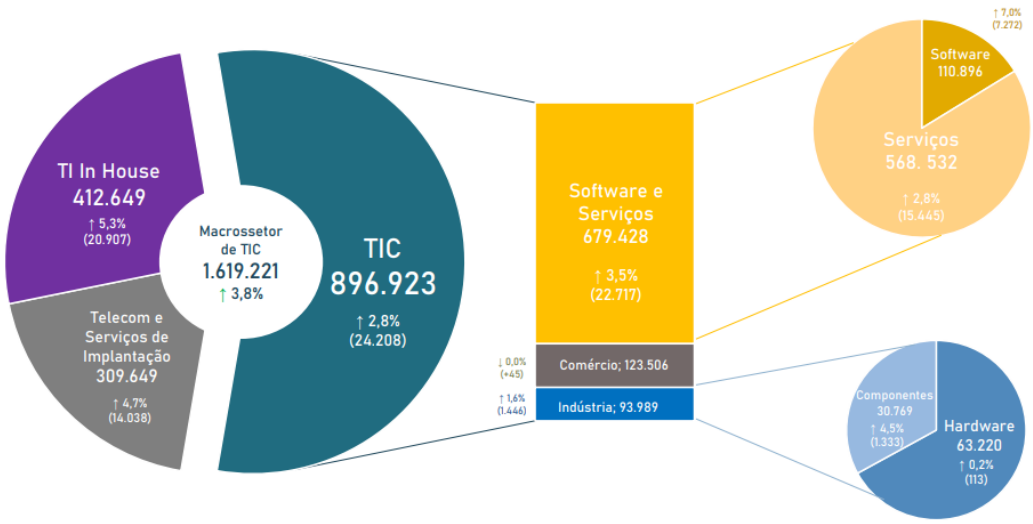
Figure 4 - Catho – Jump in vacancies between 2019 and 2020



Source: Exame Magazine/Catho 2020

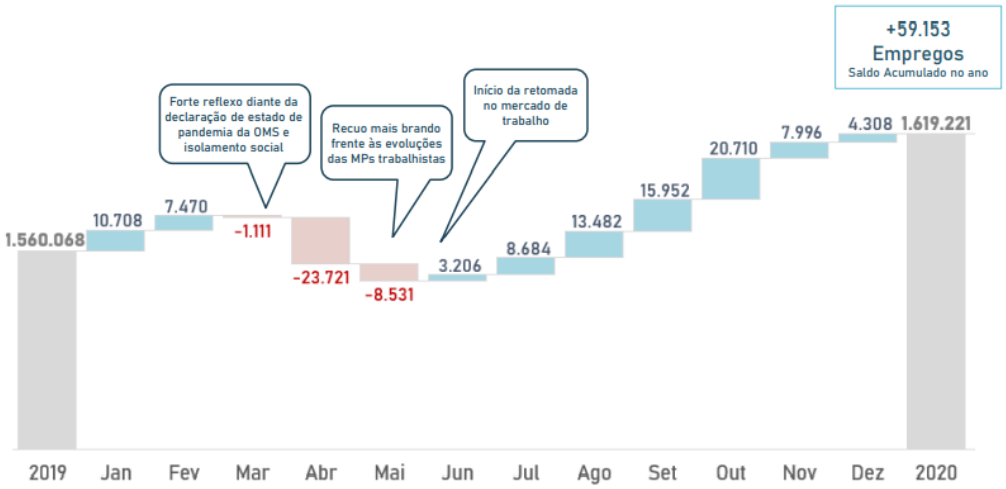
In line with Catho's analysis, ABRASCOM carried out a survey regarding the number of professionals in the ICT macro sector in 2020 and it was possible to identify considerable growth in all axes that form the Information Technology structure in Brazil as demonstrated in the two graphs below:

Figure 5 - Number of professionals in the ICT Macrossector in 2020 - BRASCOM



Source: BRASCOM, 2021.

Figure 6 - Number of professionals in the Macro ICT sector in 2020 – BRASCOM



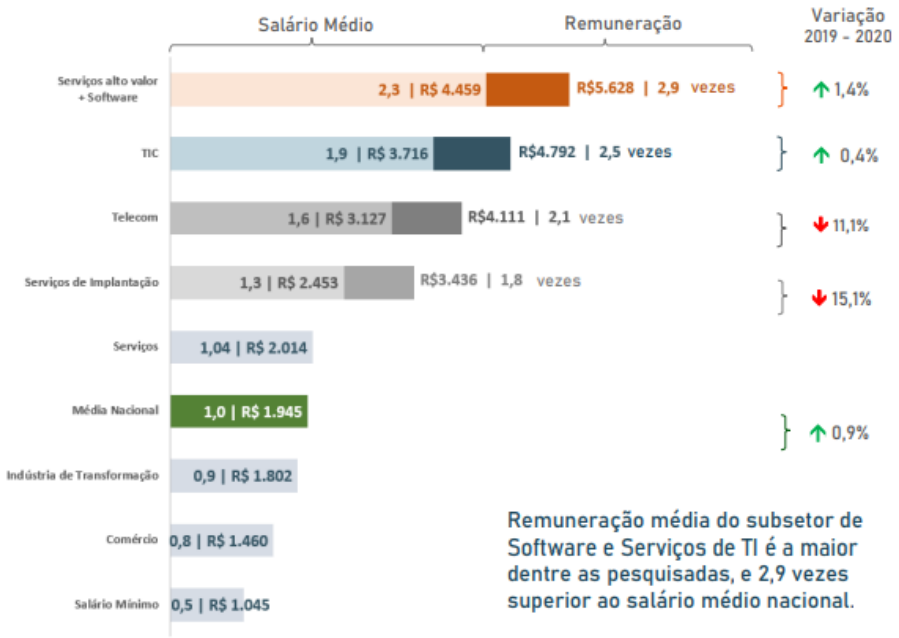
Source: BRASCOM – RAIS and CAGED, 2021.

When looking at the graphs that show the growth in demand for specialized labor in the information technology sector, these numbers directly reflect on the ability of companies in general to migrate their businesses from an economy based on analogue to digital.

From this perspective, new challenges arise for administrators with regard to the remuneration of professionals, which also increased in the same direction in the sectoral and national average comparison.

Without obstacles, a new panorama of positions and salaries permeates the financial planning that, just like in the Greek titanomachy, managers in their actions needed to articulate forces and review economic and financial strategies. This can be seen in the graphs below, which in addition to the remuneration comparison, presents a national portrait of the distribution of jobs in the IT sector across the country.

Figure 7 - Comparison of average ICT remuneration with sectoral and national average salaries – BRASCOM



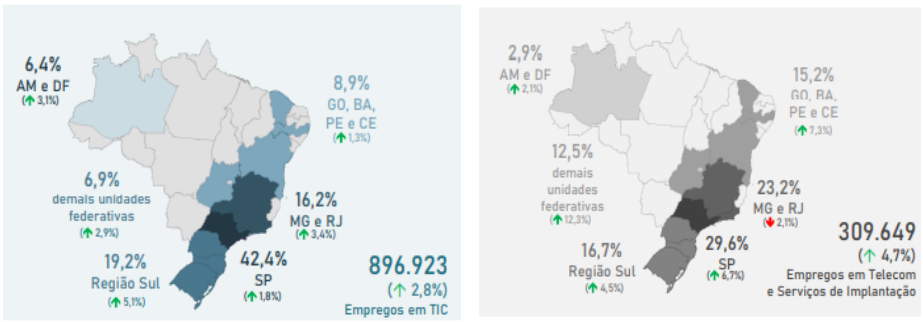
Source: BRASCOM – IBGE – RAIS - CAGED and New CAGED

The graph above, when demonstrating the comparison of average ICT remuneration with sectoral and national average salaries, shows that high-value sectors such as software and information technology showed a positive variation and grew in the order of 1.4%, within a pandemic scenario with a high degree of instability and uncertainty. Still as a complicating agent, it is worth highlighting that technology in general changes at a breakneck pace.

and new programming languages emerge all the time, so much so that IT professionals need to be up to date, which is also a huge battle.

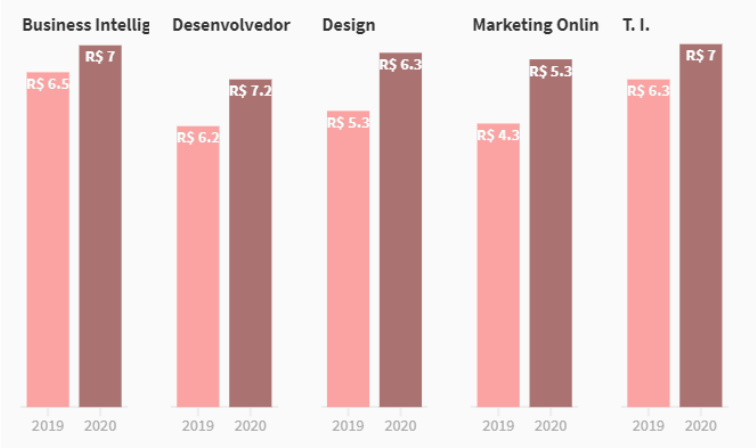
Still within the panorama of remuneration in the information technology sector, it is possible to state that the largest concentration of labor is in the Southeast, followed by the Northeast, North and the Federal District, as shown in the graph below. This concentration in the Southeast signals that in other regions of the country the shortage of labor in the IT sector is even more acute and brings all sorts of negative impacts.

Figure 8 - National portrait of job distribution – BRASCOM



Source: BRASCOM – IBGE – RAIS - CAGED and New CAGED

Figure 9 - Survey – Jump in salaries in the technology area 2019-2020



Source: Exame/Revelo.

Another positive impact factor that increases the job offer for IT professionals is the growth rate in the supply of Telecom services associated with

investments in infrastructure and access to devices such as smartphones, tablets, computers and the like. It is important to highlight that not only did remote work demand a new structure in the technology park (internal and external), but it also interfered in work relationships that needed to be supported by technology to optimize the times and movements that guide employees and leaders within organizations. .

The less optimistic perspectives vary between 1 and 10% in just two years of comparison, as can be seen in the panel below:

Figure 10 - IT Sector Growth Rate Outlook 2018-2020

Variation between 2019 and 2020

Source: BRASCOM, 2021.

In view of all that has been explained and analyzed, it is imperative that managers are reminded of the excruciating challenge of attracting and retaining qualified labor for effective action in relation to the strategy and competitive advantage of organizations within the scenario of change to a digital economy. in which new technologies are powerful tools, such as the weapons made by Hephaestus in ancient Greece and given to the Gods of Olympus led by Zeus. Mastering the use and application of new TDICs is a condition "*sine qua non*" to be prepared for other titanic battles that the future does not end.

Managers and administrators need to not only learn from the experiences of the pandemic, in terms of attracting and retaining IT employees in the present, because according to an ABRASCOM report, the Brazilian market will demand a contingent of around 420 thousand professionals between 2018 and 2024, this means that seventy thousand professionals will be needed per year until 2024 to fill the positions that will be made available by companies

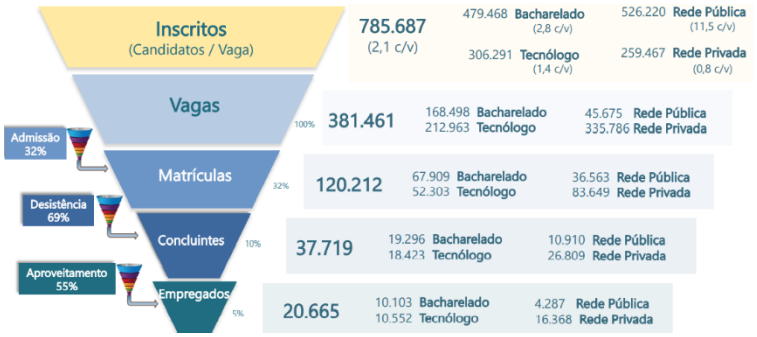
in its various sectors of the economy. And according to the same report, if there are no changes, a deficit of around 260 thousand professionals (direct and indirect) in information technology is expected.

The two biggest titans of this contemporary titanomachy that appears in front of administrators and their organizations are:

- attract and retain the best talent
- payroll relief

The first has a direct relationship with the dynamics of training and use of graduates from universities and technical schools. There is an intricate problem related to this, which is the offer of places in higher education courses (bachelors and technologists) with a low enrollment rate, on the other hand, there is a high dropout rate throughout the courses and a very low rate of graduates, of which the The utilization rate is questionable, which hinders the possibilities of hiring and remaining in the jobs offered in the TDICs sector. This can be easily analyzed in the panel below, which was developed with data and information in partnership between ABRASCOM and INEP/MEC.

Figure 11 - Characteristics of the Training and Development offer.

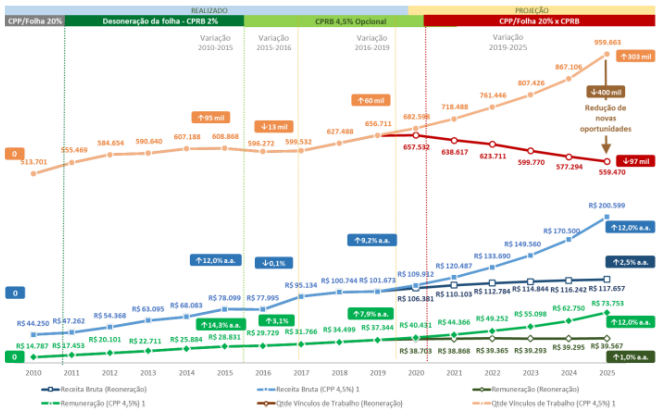


Source: BRASCOM – INEP/MEC, 2021.

The second item related to payroll tax relief has a direct impact on all medium and long-term strategic planning. This impact causes cracks at radial and axial points. The radial ones that are economic vibrate and resonate at critical points such as costs (direct and indirect) and the axial ones that are strategic planning

they echo in the structural bases, such as research and development (R&D) of new products and services. The graph below demonstrates the level of complexity of this decoupling.

Figure 12 – Challenges of the ICT sector – Payroll relief

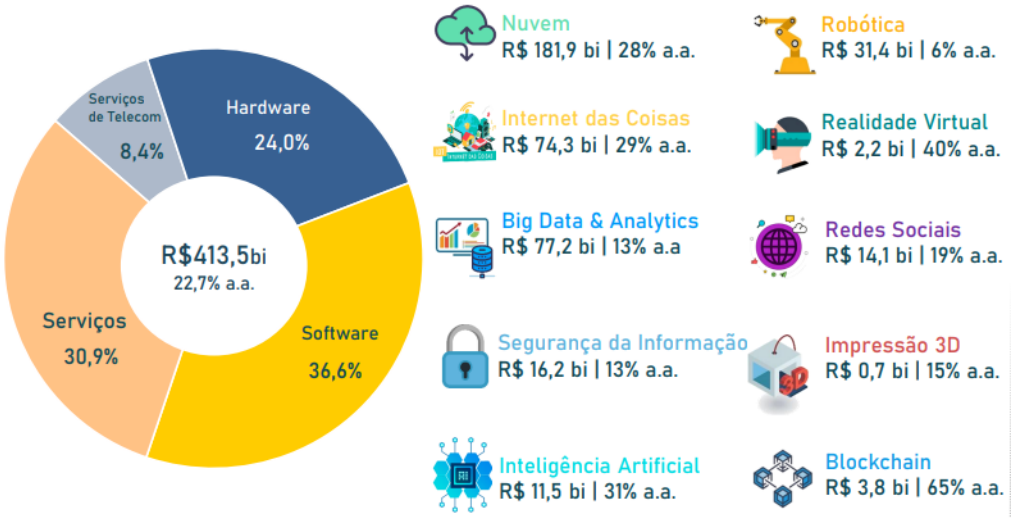


Source: BRASCOM – BACEN – IDC – RAIS and CAGED, 2021.

Both (Attracting talent and reducing payroll) are based on the central point of the decision to be part of the digital economy in which disruption is at the heart of these new products and services with high added value. This challenge of having to relieve payroll needs to have surgical precision. Administrators will be between the fury of the titans (investments with strict fiscal and budgetary control) and the energy of the Olympian gods (attracting and retaining the best talents to innovate within the market by offering products and services with high added value).

It is possible to observe the dimension of this intricate problem through the projection graph for the IT sector until the year 2025 and the graph that demonstrates the investment perspective in the sector until the year 2025, which is estimated at around R$413.5 billion with a growth of 22.7% per year

Figure 13 – Investment prospects for 2021-2024 (in billions)



Sources:BRASSCOM, IDC (Black Book 3rd Platform, 2020 H1), Frost & Sullivan (Brazil's Total Telecommunications Services Market, Forecast to 2025 - Latin America ICT Growth Opportunities.

It is inevitable for administrators and managers that in this battle there will be losses and damages. The digital economy is something new and was not foreseen in the theoretical framework of the training of the vast majority of entrepreneurs and administrators who deal with this topic.

Therefore, everything is very recent and the speed at which everything unfolds demands a new*mindset*. New ways of hiring and retaining talent with a much greater focus on partnership need to be established and strengthened to face this widespread shortage of IT professionals

Final considerations

During the Titanomachy in Greek mythology, Cronos was the one who led the insurgency against the Olympian gods, who were led by Zeus and had weapons that were forged by the God of Technology Hephaestus. In contemporary times, this allusion to the god of technology materializes through the numbers of a sector that, according to ABRASCOM, has a gross revenue of around five hundred and fifty billion in the Information and Communication Technology macro sector, which represents 6.8 in GDP. Even in the face of the inhospitable scenario of the pandemic in 2020, the sector's growth reached 4.4% with the employability of 1.62 thousand professionals with a projected increase of 59.1 new jobs.

The increase in the supply of jobs in the information technology sector can be explained by factors ranging from the social and economic effects caused by the pandemic caused by covid19, which boosted and accelerated the processes of organizations that now, in order to survive, have launched themselves into the digital economy through its businesses, products and services supported by new technologies and transactional processes, even through the change from analogue models to digital models. There is a shift from a linear and Cartesian subjectivity to a complex subjectivity mediated by the use of new technologies at all levels within companies. This change occurs consciously in many cases and unconsciously in a few cases.

The increase in the supply of technologies with internet access such as*smartphones, tablets, notebooks*and computers for both individuals and companies and the high investment in the sector that mobilizes billions of reais in the world and in Brazil, which has enormous representation of the sector in the world. With social and economic issues still unresolved, Brazil in relation to education is unable to meet the repressed demand for skilled labor in information technology.

Business administrators and managers are faced with some paradoxes and need to understand the imperfect execution of the unknown, as Kevin Kely once said. It means that administrators now need to understand that the TDICs that are now pervasive and that encourage evolution instrumented by the technology itself do not fit or do not guarantee time for their creative employees with a thirst for disruption to try to learn and develop new products and services. In this aspect, as well as in the titanomachy, the God Cronos rises to a battle in which he imposes complex areas such as attracting and retaining the best talents in information technology at the same time that it is imperative to relieve payroll within organizations.

As if this Atlas-worthy work were not enough, it also has the complicating factors of the knowledge bottleneck that exists within Brazilian universities (whether in bachelor's or technologist courses) which generally provide very few professionals with adequate training and the skills and competencies to forge new products and services with high added value to be delivered to the exponentially growing market. In fact, there are still the most optimistic estimates that point out that by the year 2024 the shortage of labor

of work will be even more pronounced at the same time that forecasts indicate an overheating of the sector.

The main trends point to massive technology investments in the Cloud that could mobilize 3.0 billion and with growth projected to exceed 45%. A*Edge Computing*only in the infrastructure modernization part, whose objective is to improve efficiency and effectiveness via automation with process optimization and consequent cost reduction, is estimated to have a scalar growth of 16% per year. Artificial intelligence will generate more than four hundred thousand dollars by 2023, in the same direction and digital management platforms (in the Cloud) will represent 14% of organizations' spending on ERP solutions. Without mobility and connectivity obstacles (data and broadband), a movement of no less than 431 billion across the world is expected, an expected increase of 4.6% per year.

Therefore, it can be concluded that the future that presents itself does not end the titanic battles that are to come for administrators and managers, who, just like in mythology, need to forge new weapons like those of Hephaestus to fight bravely using skills and competencies in information technology. for the longevity of organizations.

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