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AUTOMATION OF HUMAN LABOR: A STUDY ON THE PROBABILITY OF CURRENT OCCUPATIONS IN THE CITY OF SOBRAL/CE

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ABSTRACT

The present work investigates the impact of automation on the labor market in the municipality of Sobral, Ceará. By analyzing data from formal occupations and cross-referencing it with studies on the probability of automation, the study seeks to identify the positions most vulnerable to replacement by machines and intelligent systems in the next 10 years. The research is justified by the growing influence of technology on work dynamics. The evolution of artificial intelligence and robotics allows repetitive and manual tasks to be automated, which raises questions about the future of employment and the need for companies and workers to adapt. The study focuses on Sobral to offer a local overview of the ongoing transformations. To develop this work, a structured observation of data on formal occupations registered with the agencies for the promotion of work and employment for the city of Sobral, in Ceará, was carried out. Then, the method of Frey & Osbourne in Lima (2019) was applied to obtain the probability of automation of occupations. In this bibliometric and documentary study, in its entirety, to perceive and prospect what are the possible scenarios and possibilities that the evolution of work automation will bring in 10 years to the municipality of Ceará mentioned. It is concluded that given the importance of the theme, it is necessary to develop projects that aim at the formation of a corpus, which can trigger competencies and skills to ensure a higher quality transition for these occupations that will suffer from the changes, and that meet the different needs and, thus, implement a policy of monitoring the automated occupations and occupations created by technological changes in Sobral/CE.

Keywords: Automation. Work. Labor Market. Sobral.

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INTRODUCTION

Human work and Administration are points of knowledge that have touched each other since the origin of this science. Understanding how man thinks about tasks, performs them and what is the result of that execution is both for the man who executes and for the product of the task or process, the object of several fields of knowledge that decline to understand the phenomenon of transformation of nature by human work. Nowadays, the scientific and technological revolution of information has brought with it the perfect ability to replace people in average processes with applied robotics, the automation of work.

David (2015) argues that tasks performed by people that are manual-repetitive and cognitive-repetitive, for example, will be perfectly replaceable by automation in the next 10 years. This is due to the evolution of computing devices that have recently gained the ability to interpret and provide more complex, predictive analyses, generating scenarios and possibilities previously only possible through direct human work. This possibility opens the discussion for how the work will be in the coming years.

In view of this condition, resuming the discussion about human work and how this social dictate can suffer oscillations that will define how economies, even at the micro-regional level, such as in municipalities, is a way of understanding the dynamics posed by the market in the coming years with the growing advancement of technology. Therefore, we sought to gather data on the municipality of Sobral, in Ceará, with the purpose of answering the following questions: what are the predominant positions and occupations in the last 10 years in the city of Sobral, and how these positions may be influenced by automation in the next 10 years?

The objective of this work is to foster the discussion around the automation of work in organizations, selecting the municipal sphere to collect data from DATAMPE Brasil, CAGED, SEBRAE and other public and private entities on predominant positions in the municipality of Ceará, classified by the CBO to relate to the results of the probability of automation of Frey & Osbourne in Lima (et al., 2019) and indicate possibilities to local companies and the municipal government about the possible changes that may occur in the next 10 years, making available an initial mapping of the predominant positions in the economy of the northern micro-region of Ceará.

The advances in technology in the global market, increasingly closer to the common reality of all, is a strong ally of the economic growth of many companies, as it offers excellence in the execution of processes, as well as the improvement in the performance of

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employees who have their work combined with technological advances implemented through systems, robotics and techno-social integration between humans and robots. However, jobs are the main form of occupation currently in the human labor market and will be significantly affected in the coming years due to automation.

Therefore, by proposing to measure which positions will possibly be affected in the municipality of Ceará in 10 years, it undertakes the possibilities arising from these technologies and how they can improve occupations and even create new occupations, demonstrating alternatives for people and organizations to improve their processes and serve their customers in an increasingly personalized way, and which positions can contribute to these changes if they have, for example, repetitive and routine automated tasks.

To develop this work, a structured survey of data on formal occupations registered with the labor and employment promotion agencies for the city of Sobral, Ceará, was carried out. Then, the method of Frey & Osbourne in Lima (2019) was applied to obtain the probability of automation of occupations. In this study, it was sought through bibliometric and documentary research, with a historical series of data, involving the positions and their probability of automation, to evaluate what possible scenarios and possibilities the evolution of work automation will bring in 10 years to the municipality of Ceará.

This work is structured in four parts, the first of which presents the automation of human work and its ontological aspects in the capitalist dynamics, basing the assumption on the research of authors who discuss and bring results to the theme in a longitudinal way. In the second part, the advantages and disadvantages of the automation of human work for companies and occupations are presented. In the third part, it brings the study itself, where the data obtained on the formal occupations in the city of Sobral, Ceará were related with the probabilities obtained in the fundamental and methodological study, identifying, compiling and carrying out a brief history of the data relationship. Finally, some results obtained with data on the sectors and occupations most susceptible to work automation in the Sobralense market are presented, offering complementarily the return on the automation of tasks, prospecting alternatives on the improvement of positions and personalization of service in Boudreau & Ramstad (2019) as a possibility for people, companies and public authorities in the next 10 years.

Finally, given the importance of the theme, it considers it necessary to develop projects aimed at the formation of a corpus, which can trigger competencies and skills to

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ensure a higher quality transition to these new occupations that will suffer from the changes, and that meet the different needs of the people who occupy the current positions that, possibly became extinct and, thus, put into effect a policy of monitoring automated occupations and occupations created by technological changes in Sobral/CE.

THE AUTOMATION OF HUMAN WORK AND ITS HISTORICAL ASPECTS

The automation of human labor is a concept that portrays the ability of automated technologies and processes to replace human labor in a given activity or process, due to the optimization of labor productivity that will always incur in replacing human labor to the detriment of increased productivity. Abramovay (2021) demonstrates that this concept is the object of basic study in important authors of the Social Sciences, although contrary in their currents, such as Marx and Mill. Both authors portray that technological advances will elevate man's work to an increasingly specialized condition, in addition to reducing the scarcity of resources, which would lead to a drastic decrease in the need for economic activity for subsistence purposes. Human needs, with the advancement of technology, tend to become more complex and human jobs follow the same bias. And with this, the "permanent qualification and flexibility of work would enable new and more jobs and business opportunities, ensuring a positive balance to technological transformations" (FILGUEIRAS, 2022, p. 01). Therefore, it is necessary to understand how the historical changes in human work caused by the advancement of technology have been modifying positions and occupations throughout history, and how this current moment will influence the way we will work in the coming years.

Marson (2014) estimates that the automation of human work in post-modernity arises with the intensification of the Industrial Revolution, where trades or positions had their tasks optimized on a large scale so that the human resources of organizations could keep up with the progress that engineers and other technicians had been making with machinery. This relationship between technical development and work continued to be contrasted during the advances in mass production, especially the gains with molds and jigs, in addition to the development of cutting, measurement and precision machinery that are more technological and reliable in the industry. The occupations linked to the development of industry at the beginning of the twentieth century experienced the first major changes caused to human labor by technical advancement with the increase in unemployment or the reallocation of labor.

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Heidemann (2014) states that the current organization of work in Brazil is divided by the territorialization of work. The people and positions in the division of labor in Brazil are personified, reified by the professions, which must have an interest in fulfilling what was assigned to them in that hierarchical position and geographical location, in exchange for capital. Lanzara (2023) adds that this same subject remains inserted in a global consumption dynamic, submitting his subjectivity to a larger economic dynamic, where his activity becomes part of the sum that mobilizes money in the economy. This dynamic is anchored in the stability of occupations as the main mechanism for distributing income among families in a state of preserved civil rights. Therefore, discussing how these occupations can be affected by technological changes is also a collective issue, since changes in the labor supply can affect the consumption capacity of families, consequently the direct economic stability of the local economies where these individuals live.

The reason between technology and work contrasting is a discussion that extends to the relationship between work and capital, because it is increasingly complex to necessarily understand the value of work for man in proportion to occupation, since through human work technique has been exacerbated in its ability to provide improvement of the means of production and, with this move towards overcoming economic scarcity, the driving force of Capitalism. In a world of changes towards the greater capacity of machines to process data, to perform increasingly complex tasks, there is a need to qualify and quantify how many of these activities/tasks machines will be able to perform over the next few years, because the most inherent contradiction in this process of technological evolution is the variable *reduction of human resources x automation of tasks*. Although technology provides evolution in society, the current production model preserves the maxim of greater profitability. In this sense, by automating human tasks in a given organization, the plan immediately excludes the human labor required to perform. This dynamic generates fluctuating unemployment in cities around the world (ALBUQUERQUE et al., 2019).

Lima et al. (2019) studied the impact of this estimate on occupations in Brazil and which occupations will suffer the greatest impact, based on the Frey and Osborne (2017) method for the probability of automation of occupations using the Gaussian model. Positions in Brazil follow a heterogeneous pattern to the same occupations in other parts of the world. In the results, the authors demonstrated that positions that involve creativity and customer service have a growth trend. Other professions, such as accountant and elevator operator, would be fully automatable. These probabilities serve, therefore, to demonstrate

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that some sectors of the economy, in particular, may be more affected than others, which raises the need for discussion on how economies, even at the micro-regional level such as in municipalities, should deal with these global demands brought about by technological advances.

It is also necessary to emphasize that the changes in the Economy, the influence of exogenous factors to the occupation of human labor directly influence the offer of employment even in a municipal economy, such as in the city of Sobral, however the objective of this work is to demonstrate which the current occupations in the city of Sobral will possibly be affected by the evolution of technology crossing with the results obtained by the Laboratory of the Future at the Federal University of Rio de Janeiro *in* Lima et al. (2019) for the probability of automation of occupations in Brazil and to compare it with the available data on current occupations in the city of Sobral, Ceará.

To obtain data on occupations in Sobral, we consulted the IPECEDATA databases (2024) which showed in 2022 a total of 54,218 occupations, divided into 8 main categories: mineral extraction, manufacturing industry, public utility services, civil construction, commerce, services, public administration, livestock, plant extraction, hunting and fishing. The formal numbers in stock in the CAGED data show a stock of occupations, up to April, of 51,654 formal occupations and there were 1,175 admissions, 1,017 dismissals, resulting in a balance of 158 occupations, generating a positive relative variation for the indicator. However, there are fewer people formally employed between 2022 and 2024, more precisely 2,564 people in Sobral (BRASIL, 2024).

TABLE 1: ECONOMIC SECTORS BY NUMBER OF OCCUPATIONS IN CEARÁ BETWEEN 2019 AND 2021

Formal Jobs in Ceará between 2019 and 2021 (total in thousands)						
Economic Sectors	Number of jobs per year according to CAGED			Average Occupancy	Probability of automation of occupations in Lima (et al., 2019)	Number of occupations possibly affected in Ceará
	2019	2020	2021			
Services	908,4	872,8	931,3	904,2	0,63	569,6
Trade	253,5	246,5	257,8	252,6	0,76	192,0
Construction	59,1	63,6	67,8	63,5	0,71	45,1
Agricultural	20,7	21,5	22,2	21,5	0,78	16,7
General Industry	236,9	237	249,8	241,2	0,74	178,5

Source: Impacts of the Pandemic on the Labor Market (BNB, 2024)

The scenario of changes in occupations, mainly related to the automation of work from the historical-economic point of view of the exchange of values for hours of work of the

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man considered as a craftsman of a trade, becoming a professional who specializes in the execution of predetermined tasks in organizations, whether these organizations are of a public or private legal nature, follows the path to a more detailed incursion into the recent changes in the way men work. Souza et al. (2023) address that the division of labor, a process intrinsic to the development of societies and companies, goes through three stages: that of rudimentary labor (hunting, fishing, subsistence agriculture), that of domination by war (emergence of war, division into classes, surplus of production, gradual extinction of slavery) and that of the rise of trade (strengthening of commerce and aristocracy, emergence of bourgeois society and the working classes). The aegis of work is inseparable from the development of society itself at a global level and, therefore, the current phenomenon of work automation can also have impacts on society on the same scale.

From the point of view of human labor in this process, Sousa (et. al, 2023) introduces dimensions such as condition 1) biological, from which the subject transforms nature to produce his own existence; also 2) social, related to the society in which it is inserted; the very expression and form of the subject being inserted in the social environment, generating dimensions and layers in the social fabric for each portion of each subject's contribution. Finally, also 3) subjective, because it represents for the subject the intrinsic value of subjectivity, of the representation of the phenomenon of "working" for each being. In addition, the current moment in human history and the division of labor, in which society and organizations are inserted in context, is increasingly complex for both public social organizations and private companies. The influence of the intense technocratic revolutions carried out during the growth of private property, the strengthening of industry and the technological expansion in manufacturing processes, gave rise to the automation of human labor; the autonomy and learning of machines in certain activities. For this reason, rethinking the biopsychosocial character of human work is the first recommendation of this study in the current context of the work revolution. How to think about an organization with and without people? How do teams face the increasingly complex human-machine interaction? How have changes in technology affected and will continue to affect job titles? Although it is not the purpose of this study to delve into the relations between work and the dimensions that make it from an ontological point of view, inevitably when we approach the rationalization of human work and, moreover, the automation of human work, these three

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dimensions will directly influence the employment factor, which is currently the main form of formal occupation in the world.

Albuquerque et. al. (2019, p. 7) brings in his study on formal occupations in Brazil in the next century that there is a downward trend in specific types of employment, such that the: "i) routine manual; ii) non-routine manual; iii) routine cognitive; and iv) non-routine cognitive." are the jobs that are possible to be automated in the coming years. This is because the occupation of these functions is being improved by the automation of work, which has been driven by the emergence and strengthening of predictive algorithms and artificial intelligence. Boudreau et. al (2017) addresses that in this new phase of work, the positions that have more and more personalization in the relationship with the customer will be the positions that will best adapt to the most recent changes in the offer of employment at a global level. This is because algorithms will provide greater customer understanding capacity for organizations, which, in turn, must choose to train their teams in order to provide personalized service to their end customer.

ESTIMATES ON THE PROBABILITY OF AUTOMATION OF OCCUPATIONS IN THE CITY OF SOBRAL/CE

PROBABILITY OF AUTOMATION OF OCCUPATION BY AGE GROUP

The municipality of Sobral, in Ceará, is of great importance to the economy of Ceará, being the second municipality that exports the most in the state according to data from the Federation of Industry and Commerce – FIEC.[4] According to the IBGE, [5]Sobral occupies the 5th occupation among the economies of the 184 municipalities of Ceará. With a GDP per capita of about R$ 25 thousand/average, a nominal gross revenue of just over approximately 1.2 trillion, with more than 98% of assets committed, the city stands out in Education and has an economy with a strong participation of the Industrial sector, followed by Commerce and the Services sector, with the participation of the Agriculture sector and the Extractive Industry.

According to data from DATAMPE, Sobral has just over 54 thousand formal occupations registered until 2022, most of them among people aged 16 to 39. This profile

[4] "Focusing on Ceará's industrialists, the FIEC System offers complete solutions in health, education, technology and innovation, aiming at professional development and competitiveness of the industrial sector (FIEC, 2024, sp.)".
[5] "The IBGE is the main Brazilian body responsible for collecting, analyzing, and disseminating data about the country, serving both civil society and governments (BRASIL, 2024, sp.)".

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shows that 70% of formal occupations in Sobral are occupied by young people, with an average age of 27.5 years, making the population of Sobral an important municipality to be studied, since, according to Lima et al. (2019) the probabilities of automation of occupations point to an average percentage of 64% of formal occupations in this age group gap.

TABLE 2: PROBABILITY OF AUTOMATION BY AGE GROUP IN THE CITY OF SOBRAL/CE

Age group	Number of Occupations by Age Group	Probability of Automation of Occupation by Age Group (LIMA et al., 2019)	Estimated number of occupations affected by age group
10<15	43	0,85	37
16<24	7851	0,76	5967
25<29	9538	0,66	6295
30<39	18759	0,61	11443
40<49 months	11321	0,61	6849
50<64	6272	0,63	3920
65>	434	0,61	263

Fonte: Lima et al. (2019, p. 22)

PROBABILITY OF AUTOMATION OF OCCUPATION BY LEVEL OF EDUCATION IN THE CITY OF SOBRAL

In a sample of 32,720 respondents, data from DATAMPE (2024) also point out that the labor market in Sobral/CE is composed of all levels of education available in conventional economic tables. The results of Lima et. al. (2019) point to a greater susceptibility to automation of activities and occupations that involve a low level of complexity, consecutively requiring less specialty. The level of education of more than 50% of the occupations in the municipality in the north of Ceará is complete high school. This data, in itself, demonstrates that the tendency for occupations at this level of education is to be more vulnerable to technological changes, as their tasks are less complex and tend to be more repetitive. "In this sense, education and vocational training appear today as central issues because they are given essentially instrumental functions, that is, capable of enabling competitiveness and intensifying competition, adapting workers to technical changes and minimizing the effects of unemployment (SEGNINI, 2000, p. 7)".

Sobral is nationally recognized for its progressive numbers of IDEB – Basic Education Development Index, which measures the quality of learning in schools and education networks. Gramani (2016) shows that between 2005 and 2013, the Sobral index went from 4.0 to 7.8 – a percentage of 195%, almost doubling its results in the indicator between decades (BRASIL, 2024). Data from the indicator in 2023 show average stability in

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the last 10 years, with an IDEB of 7.9. However, when we move on to other levels of education, which can influence the relationship between population and work in a more direct way, such as the indices of higher education and post-graduation, the result of the predominant population in the labor market of the city of Sobral demonstrates a certain distortion, with the population with a predominance in higher secondary level occupations in 62% more than the sum of all occupations at higher education levels, from even the population with incomplete higher education to doctors. See table below:

Table 1: Probability of Automation by Level of Education in the City of Sobral/CE

Média do número de Ocupações por Nível de Ensino em Sobral/CE segundo o DATAMPE de 2016 a 2022 e as probabilidades de automação in Lima (et al., 2019)

Nível de Educação	2022	2021	2020	2019	2018	2017	2016	Média do nº de ocupações por nível de ensino entre Anos (arred.)	%	Probab. de Automação Por Nível de Ensino no Brasil em Lima (et al., 2019)	Nº médio de ocupações suscetíveis (arred.)
Analfabeto	158	159	147	165	163	166	181	163	0,50%	86%	140
Educação Fundamental Incompleta	1996	2070	1937	2034	2110	2190	2321	2094	6,40%	80%	1673
Educação Fundamental Completa	1564	1610	1662	1642	1769	2014	2153	1773	5,42%	79%	1392
Ensino Médio Incompleto	1923	2437	2808	2628	3124	3367	3325	2802	8,56%	80%	2227
Ensino Médio Completo	19573	17527	17672	15197	16089	15382	14838	16611	50,77%	78%	12957
Ensino Superior Incompleto	2458	1936	2044	1986	2151	1967	1759	2043	6,24%	72%	1461
Ensino Superior Completo	8812	6543	7251	6254	6969	5725	4769	6618	20,23%	61%	4004
Pós-graduação e Mestrado	559	603	566	469	389	334	242	452	1,38%	39%	176
Doutorado	238	200	191	155	131	130	106	164	0,50%	28%	46
Soma	**37281**	**33085**	**34278**	**30530**	**32895**	**31275**	**29694**	**32720**		**74%**	**24075**

Source: Lima et al. (2019, p. 22)

According to data published by the Federation of Industry and Commerce – FIEC, in 2019, a study carried out with 104 industries in Ceará showed that about 60% of the participating companies had difficulty hiring qualified labor, with an increase of about 7% if considering large industries. Sobral has in its occupations a significant portion linked to

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Industry, mainly manufacturing. The data from this study sponsored by the federated agency also show that on-site they tend to directly affect production lines, due to the "absence of technicians, operators, and engineers (FIEC, 2024, p. 3)". The contrast is even more striking if we weigh the significant number of higher education institutions in Sobral/CE which, according to Lopes (2020) with emphasis on five face-to-face institutions, between public and private, which offer 68 modalities of higher education, 43 bachelor's degrees, 19 bachelor's degrees and 6 technological, in addition to 13 Master's courses in these local institutions.

> "According to the Basic Municipal Profile of Sobral (2005), the Gross Domestic Product (GDP) of Services corresponds to 54.8%; while Industry adds up to 43.4%; followed by Agriculture, with 1.7%. We found that the GDP of Services contributes to the economy of Sobral, which reinforces that the specializations generated by this sector accentuate its role as a regional center. This type of activity (modern services) attracts to the territory of Sobral a greater content of science, technology and information, having a direct impact on the spatial structures of the city and its role in the territorial division of labor (FREIRE et al., 2011, p. 49)".

In the study carried out in 2021 by the partnership between Germany and Brazil, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in cooperation with the Center for Organizational Engineering, Department of Production and Transport Engineering of the Federal University of Rio Grande do Sul (UFRGS) shows that it is expected that more than 60% of occupations in industries, commerce and services will be affected by technological changes by 2035. However, new professions and skills will serve as beacons between the readjustment of specialized labor and the maintenance of employment rates. To this end, the study recommends delving into new professions and specialties, listing some professions that should be boosted by the demand for technology and information in the coming years.

TABLE 3: NEW PROFESSIONS THAT WILL BE BOOSTED BY THE DEMAND FOR IT

Emerging professions
Software and IT Area
Social Media Manager, Programmer/Coder, Cloud Specialist , Cybersecurity Analyst, Software Engineer, Artificial Intelligence Specialist, Data Scientist, Database Engineer, Blockchain Specialist, Digital Game Programmer, Multimedia Programmer, Systems Developer.
Manufacturing and productive services sector
Digital Transformation Analyst/Industrial Digitalization Expert, Digital Operator, Electronic Control Unit Programmer, Vehicle Computer Technician, Trends-Innovation Manager, Logistics Planning Professional, 3D Printing Professional, Electromechanical Technician, Robotic Process Drivers, Propulsion Exoskeleton Engineer, Electromobility Professional, Telemetry Specialist Mechanic, Service Specialist, Economy Manager circular.

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Agriculture sector
Drone Operator, Digital Agriculture Technician, Agricultural Machinery Designer, Urban Farmer, Digital Agronomist Engineer, Digital Agribusiness Technician, Agricultural Data Scientist, Agricultural Automation Engineer.
Healthcare
Hospital engineer, Telemedicine technician, Quality of life manager, Genetic counselor, Geomicrobiologists, Bioinformaticist, Digital health care technician, Digital consultant, Analytical consultant, Complex care manager physician / care integrator, Procedural physician; Health Data Engineer; Production Engineer/Bed Management; Digital caregiver.

SOURCE: NEW ADAPTED PROFESSIONS BY FRANK ET AL. (2021, P. 72-78)

Sobral has higher education courses at the undergraduate, licentiate, technological, lato *sensu* and *stricto sensu* graduate levels at the master's and doctoral levels. By considering, for example, a greater promotion of the public power the creation of new *stricto sensu* graduate courses in all undergraduate courses in Sobral, the capacity to cover higher education in the city of Ceará would demonstrate varied capillarity, since it has a varied range of undergraduate courses in the most diverse areas of science, in face-to-face and distance modalities. This debate should resume the political possibilities of the municipality to create measures that use its installed capacity, even if between Public and Private HEIs through partnerships such as PPP's[6], widely used in other contexts of the Sobral economy, such as recycling, preservation of springs and springs, preservation of cultural heritage, etc.

> "The production and updating of technological knowledge require investments in personnel, equipment, structure, didactic material, etc., that are not necessarily compatible with the most urgent demands of the market, which are, in many cases, of a strictly pragmatic nature, in a context of structural and technological unemployment, and in a historical conjuncture in which the political dimension has been emptied and has undergone a process of technicality of a managerial nature (FERRETTI, et al., 2000)".

[6]The Public-Private Partnership (PPP) is a collaboration contract between the public and private sectors to manage works and services of public interest (BRASIL, 2024).

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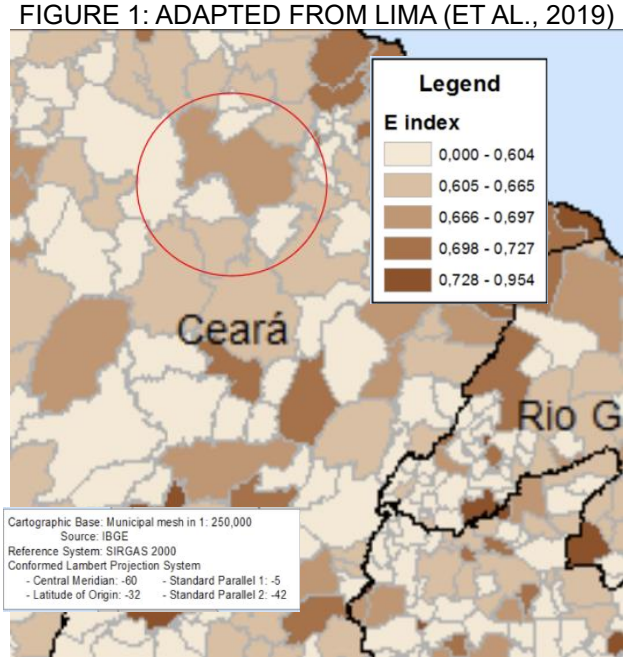
PROBABILITY OF AUTOMATION OF EMPLOYMENT BY SECTOR OF THE ECONOMY IN THE CITY OF SOBRAL

FIGURE 1: ADAPTED FROM LIMA (ET AL., 2019)



The research by Lima (et al., 2019) on the probabilities of automation of occupations in Frey & Osbourne (2017) as one of the seminal articles in this field of research, demonstrates that the northern micro-region, where Sobral is located, is predominantly in the third quintile, with localities in the second and first quintile. On average, the spatial probability demonstrated in the figure above by the authors suggests that, on average, 67% of the occupations per economic sector in the northern micro-region of the Sertão de Sobral may be affected by new technologies.

The economy of Sobral, according to data on gross value added by Economic Sector *in* DATAMPE (2020) is composed of four major economic sectors: agriculture (1.2%); industry (22.5%); services (55.3%) and public administration (21.1%).

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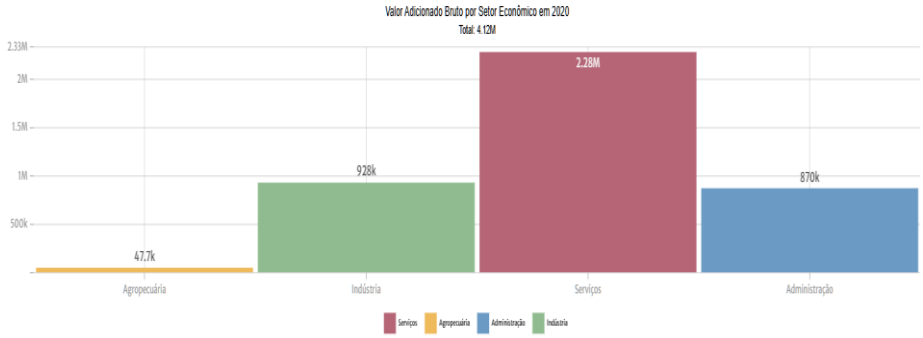
FIGURE 2: ADAPTED FROM DATAMPE (2020)



In the economy of Sobralense, if we consider the relationship between the data on the grouping of occupations according to the Brazilian Classification of Occupations (CBO) and the data available by DATAMPE, the sample can be divided into 9 groups: (1) Senior Members of the Public Power; (2) Directors of Public Interest Organizations and Companies, Managers; (3) Science and Arts Professionals (4) Secondary Level Technicians; (5) Administrative Services Workers; (6) Service Workers, Retail Sellers in Shops and Markets; (7) Agricultural, Forestry and Fishing Workers; (8) Workers in the Production of Industrial Goods and Services; (9) Workers in Repair and Maintenance Services.

This division made it possible to confirm the trend of studies in the area also in the city of Sobral, since the occupations in more noble groups of the CBO, such as public administration workers, although in a much smaller population compared to service and industry workers, this has a tendency to be less "automatable", since their labor relations are generally permeated by legal processes, where the rules are previously established by other higher or supervisory bodies. Occupations in industry, commerce and services will be more influenced by technological changes and, in Sobral, this portion of occupations represents more than 70% of the occupations in the sample, demonstrating the need to pay attention to fluctuating unemployment in both sectors in the coming years, as shown in the table below

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TABLE 2: COMPARISON BETWEEN OCCUPATIONS CLASSIFIED BY THE CBO GROUP IN SOBRAL/CE AND THE PERCENTAGE OF OCCUPATIONS POSSIBLY AFFECTED BY WORK AUTOMATION

CBO Group (description)	Sum of occupations by Economic Group Classified by CBO in Sobral	Sum of occupations with probability of automation by Economic Group in Sobral	% by CBO economic group
Senior members of the public authorities, leaders of public interest organizations and companies, managers	967	48	5%
Science and Arts Professionals	4462	493	11%
Mid-level technicians	4608	1969	43%
Administrative Services Workers	4133	2915	71%
Service workers, retail vendors in shops and markets	5231	3546	68%
Agricultural, forestry and fishing workers	132	109	83%
Workers in the production of industrial goods and services	11764	8721	74%
Workers in the production of industrial goods and services	1250	1041	83%
Workers in repair and maintenance services	599	447	75%
Sum	33146	19289	

SOURCE: LIMA ET AL. (2019, P. 23)

> "The anticipated transition to the service society has been accompanied by substantial transformations in the functioning of the labor market. As a result, the temporality underway in the Brazilian world of work differs profoundly from that observed in previous periods of predominance of both agrarian and urban and industrial society" (POCHMANN, 2020. p. 98).

The percentages indicated by the economy of Sobral follow a worldwide trend of succession of society towards the economic predominance of services and industry, leveraged by changes in the world of work.

METHODOLOGY

The methodology of the fundamental data for this study in Lima et al. (2019) was based on the Brazilian Classification of Occupations (CBO), which was carried out in collaboration between the Ministry of Labor and Employment (MTE) and the United Nations (UN). This classification was based on others already in force, such as the International Standardized Classification of Occupations of the International Labor Organization (ILO). The most recent version of the CBO contained 2,621 occupations. These data served as a basis to associate with social indicators available about the city of Sobral/CE on sites such as DATAMPE, maintained by SEBRAE, and which gathers data compiled from RAIS – Annual Report of Social Information, CAGED – General Register of Employed and

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Unemployed Persons, INEP – National Institute of Educational Studies and Research Anísio Teixeira, which provide data on education in the municipalities. The methodology of Lima et al. (2019) uses the same sources to prepare a national study, and this study innovates by bringing a micro-regional view of one of the cities with relevance to Education in the country.

The study by Lima et al. (2019) uses the automation probabilities of occupations from the study by Frey & Osbourne (2017), which were available in Brazil through the Institute for Applied Economic Research (IPEA), since the original study used Standard Classification of Occupations (SCO) and it was necessary to convert this data into pairs. In this sense, the authors' seminal study classified and disseminated the data in accordance with the O*NET classification, which in turn is the basis for the Brazilian Classification of Occupations (CBO). By relating the classified data to the data released by DATAMPE, which classify occupations in the municipality of Sobral/CE according to the CBO, this study was responsible for relating the data and adapting them to the view on the municipality of Ceará, searching for the occupation classifier in a sample of approximately 35 thousand occupations in the city of Sobral in the year 2022, relating them to the probability of automation of the occupation treated by Lima et al. (2019). In all, approximately 35 thousand occupations were classified in Sobral/CE, in 2022, according to their degree of susceptibility to automation.

This is a bibliometric study, carried out through a structured survey of data on formal occupations registered with the agencies for the promotion of work and employment for the city of Sobral, in Ceará, on the future of the city's occupations, given their social and economic relevance for the State of Ceará. The scientific databases SciElo and FGV Repository were mainly used for bibliographic searches that supported it, making it well referenced and updated. The searches also revealed that the theme is recent and has publications with a predominance in the last 5 years. Then, the method of Frey & Osbourne *in* Lima (2019) was applied to obtain the probability of automation of occupations. In this study in its entirety, it was sought through a bibliometric and documentary research, with a historical series of data, involving the positions and the probability of their automation, to evaluate what possible scenarios and possibilities the evolution of work automation will bring in 10 years to the municipality of Ceará.

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RESULTS AND DISCUSSION

Most occupations in Sobral are concentrated between the ages of 16 and 49 years, with 2/3 between 30 and 49 years, with a predominance of occupations that require only complete high school education. In this sense, the results point to greater exposure of occupations in the municipality of Sobral/CE, as the technologies that are being created and modified recently point to a greater capacity to perform tasks of positions that are routine, with a lower degree of complexity. The average number pointed out for the percentages obtained in Sobral/CE is 64% of occupations in this profile to be affected by changes due to technology by 2035. This goes back to the need for a more in-depth analysis of the Government with the economic sectors on the coordinated adoption of technologies that can improve productivity, but that also preserve the ability of the labor market to adapt to the point of not negatively interfering with employability.

Of the economic groups in the city of Sobral/CE, the results obtained by the study reveal the concentration of occupations between the industry and services sectors, with the degree of automation of occupations in these economic sectors being 74% and 63%, respectively, according to Lima et al. (2019). These occupations could also be classified by subgroups, which show the concentration of occupations among Workers in the Production of Industrial Goods and Services (35.49%) and Service Workers, Sellers in Stores and Markets (15.78%). These occupations demonstrate, on average, a probability of automation of 71%, which may indicate which direction of which people and positions need greater qualification in the coming years so that they can adapt to the changes to which agents are subject in the labor market in the city of Sobralense. Another relevant factor in the economy of Sobral is the installed capacity of higher education institutions, which makes it possible to project solutions for these changes through scientific collaboration between public authorities and these institutions for a permanent investigation of these changes and possible impacts in the coming years in the city in the north of Ceará, especially in the context of the qualification of new professionals for the emerging labor market that will emerge if the trends pointed out take place in the present space.

Another highlight for the study is the susceptibility to automation of administrative activities, which exceeds 70%. Administrative services usually involve routine, repetitive activities, so this number was quantified considering these bureaucratic routines. However, if activities involving problem solving and conflict mediation are observed, these averages drop to 15%. This demonstrates that the future for Administrators may be one of a more

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horizontal management, where positions are less operational and more executive, and where professionals should have a greater level of autonomy for analysis within their respective areas. The challenge for new professionals requires training in democratic leadership, knowledge of retention tools, and collaboration of people and technologies.

In the city of Sobral, the numbers show that these prominent professionals are mainly divided into industry and commerce, and it is necessary to understand, in future studies, the degree of influence of automation on the psychodynamics of work in order to be able to measure what are the psychic impacts that technological changes will bring to employees who have their functions fully or complementarily automated, as well as those who migrate professions, adapting to new market demands.

FINAL CONSIDERATIONS

The changing landscape of occupations around the world is one of the most impactful since the Industrial Revolution. These changes are mainly caused by the development of innovations in various aspects, new technologies and computational devices, such as artificial intelligence, robots for mutual collaboration with humans through voice commands and gestures, among others. Management is a science that studies organizations, which are predominantly affected by changes in occupations and in the way human work will be developed in the coming years, needing to understand and have studies that contemplate this gap in a permanent and broader way.

In this study, we sought to carry out an initial mapping of the probabilities of automation in the city of Sobral/CE, where it was demonstrated that sectors of great relevance to the municipality's economy have high probabilities of suffering from technological changes by 2035. The need to deepen these numbers is imminent, so that it can estimate more precisely in which tasks the greatest capacity to execute artificial intelligences that can automate the occupations with the highest probability of automation are concentrated. Another consideration is the psychodynamic character of human work, which numbers and percentages alone cannot contemplate, thus requiring a complementary deepening of the impacts on the routine and lives of people affected by changes arising from new technologies.

It is concluded that given the importance of the theme, it is necessary to develop projects that aim at the formation of a *corpus*, which can trigger competencies and skills to ensure a higher quality transition to these occupations that will suffer from the changes, and

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that meet the different needs of the people who occupy these positions and, thus, implement a policy of monitoring automated occupations and occupations created by technological changes in Sobral/CE. In this sense, the use of resources from higher education institutions in Sobral allows professors to mediate the teaching/research process in a more enriching way, motivating academics to produce research in order to understand the changes and present to the public authorities alternatives that can be implemented as public policies for the preservation of occupations and employment in the city of Sobral.

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