THE HIDDEN SIDE OF GENERATIVE ARTIFICIAL INTELLIGENCE: INVISIBLE LABOR, ENERGY CONSUMPTION, AND ETHICAL CHALLENGES IN THE CASE OF CHATGPT

O LADO OCULTO DA INTELIGÊNCIA ARTIFICIAL GENERATIVA: TRABALHO INVISÍVEL, CONSUMO DE ENERGIA E DESAFIOS ÉTICOS NO CASO DO CHATGPT

EL LADO OCULTO DE LA INTELIGENCIA ARTIFICIAL GENERATIVA: TRABAJO INVISIBLE, CONSUMO ENERGÉTICO Y DESAFÍOS ÉTICOS EN EL CASO DE CHATGPT

https://doi.org/10.56238/sevened2025.030-012

Antonia do Espirito Santo Teixeira Araújo[1], Deivison Furtado Cabral[2], Odirlei Soares de Mesquita[3], Gleisson Aamaral Mendes[4], Wilker José Caminha dos Santos[5]

ABSTRACT

Generative artificial intelligence, represented by tools like ChatGPT, has revolutionized content production, communication, and task automation. However, little discussion surrounds the hidden impacts of its creation and maintenance. This article aims to problematize the invisible costs of generative AI, exploring three main axes: intensive energy consumption, dependence on invisible human labor, and the ethical implications of this technological model. Training language models requires large volumes of data and computing power, resulting in significant carbon emissions and energy consumption, which raises environmental concerns. Furthermore, behind the supposed autonomy of AI, there are thousands of workers, often in countries of the Global South, who perform labeling, filtering, and content moderation tasks under precarious working conditions, constituting so-called ghost work. Finally, the article discusses algorithmic opacity and the centralization of power in a few corporations, factors that hinder the democratic governance of technology. Based on scientific articles, technical reports, and investigative reporting, this study seeks to offer a critical and up-to-date analysis of the side effects of generative AI, proposing reflections on technological justice, transparency, and sustainability. By revealing what lies behind the intelligent interface, it hopes to contribute to an ethical and informed debate about the future of artificial intelligence.

Keywords: Generative AI. Ghost Work. Technological Sustainability. Governance.

[1] Bachelor's Degree in Software Engineering. Universidade Estadual do Pará (UEPA). Pará, Brazil. E-mail: annia.araujo@gmail.com
[2] Graduating Bachelor of Science in Software Engineering. Universidade Estadual do Pará (UEPA). Pará, Brazil. E-mail: deivisoncabral59@gmail.com
[3]Graduating Bachelor of Software Engineering. Universidade Estadual do Pará (UEPA). Pará, Brazil. E-mail: deivisoncabral59@gmail.com
[4] Doctorate student in Environmental Sciences. Advisor. Universidade Estadual do Pará (UEPA). Pará, Brazil. E-mail: gmendes@uepa.br
[5] Systems Engineering Specialist. Co-advisor. Universidade Estadual do Pará (UEPA). Pará, Brazil. E-mail:wilkercaminha@uepa.br

RESUMO
revolucionado a produção de conteúdo, comunicação e automação de tarefas. No entanto, pouco se discute sobre os impactos ocultos envolvidos em sua criação e manutenção. Este artigo tem como objetivo problematizar os custos invisíveis da IA generativa, explorando três eixos principais: o consumo energético intensivo, a dependência de mão de obra humana invisibilizada e as implicações éticas desse modelo tecnológico. O treinamento de modelos de linguagem demanda grandes volumes de dados e poder computacional, resultando em significativa emissão de carbono e consumo de energia, o que levanta preocupações ambientais. Além disso, por trás da suposta autonomia da IA, existem milhares de trabalhadores, muitas vezes em países do Sul Global, que realizam tarefas de rotulação, filtragem e moderação de conteúdo em condições laborais precárias, configurando o chamado ghost work. Por fim, discute-se a opacidade algorítmica e a centralização do poder em poucas corporações, fatores que dificultam a governança democrática da tecnologia. Com base em artigos científicos, relatórios técnicos e reportagens investigativas, este estudo busca oferecer uma análise crítica e atualizada sobre os efeitos colaterais da IA generativa, propondo reflexões sobre justiça tecnológica, transparência e sustentabilidade. Ao revelar o que há por trás da interface inteligente, espera-se contribuir para um debate ético e informado sobre o futuro da inteligência artificial.

Palavras-chave: IA Generativa. Ghost Work. Sustentabilidade Tecnológica. Governança.

RESUMEN
revolucionó la producción de contenidos, la comunicación y la automatización de tareas. Sin embargo, se habla poco de los impactos ocultos que conlleva su creación y mantenimiento. Este artículo pretende problematizar los costos invisibles de la IA generativa, explorando tres ejes principales: el consumo intensivo de energía, la dependencia del trabajo humano invisible y las implicaciones éticas de este modelo tecnológico. El entrenamiento de modelos de lenguaje requiere grandes volúmenes de datos y potencia informática, lo que genera importantes emisiones de carbono y consumo de energía, lo que genera preocupaciones medioambientales. Además, detrás de la supuesta autonomía de la IA se esconden miles de trabajadores, a menudo en países del Sur Global, que realizan tareas de etiquetado, filtrado y moderación de contenidos en condiciones laborales precarias, lo que constituye el llamado trabajo fantasma. Por último, discutimos la opacidad algorítmica y la centralización del poder en unas pocas corporaciones, factores que obstaculizan la gobernanza democrática de la tecnología. Basado en artículos científicos, informes técnicos y reportajes de investigación, este estudio busca ofrecer un análisis crítico y actualizado de los efectos secundarios de la IA generativa, proponiendo reflexiones sobre la justicia tecnológica, la transparencia y la sostenibilidad. Al revelar qué se esconde detrás de la interfaz inteligente, esperamos contribuir a un debate ético e informado sobre el futuro de la inteligencia artificial.

Palabras clave: IA Generativa. Trabajo Fantasma. Sostenibilidad Tecnológica. Gobernancia.

1 INTRODUCTION

In recent decades, artificial intelligence (AI) has gone from a field of research restricted to academia to a technology that is widely incorporated in various sectors of society. Among its most recent developments, generative AI stands out, represented by models such as OpenAI's ChatGPT, which today is already capable of producing texts, images, codes, and other content in an apparently autonomous way. This innovation has been celebrated for its ability to optimize processes, increase productivity, and profoundly transform the way we communicate and work. However, behind the fluid interface and intelligent responses, there is a complex technical, human, and energy infrastructure that is often ignored or made invisible in public and academic debates. (Ooi et al., 2025)

For this article, we start from the premise that all technology carries social, political, environmental, and ethical implications. Generative AI, despite its "clean" and digital appearance, relies on an invisible production chain that includes low-paid workers who perform fundamental tasks such as labeling and data moderation, a process known as ghost work (GRAY; SURI, 2019). In addition, the training and operation of large language models require immense volumes of electrical energy and computational resources, contributing to environmental impacts that are still poorly measured (BENDER et al., 2021). Added to this is the centralization of technological development in large corporations, which raises concerns about transparency, governance, and technological justice.

Given this scenario, the article aims to critically discuss the invisible aspects of generative artificial intelligence, focusing on three central axes: (1) energy consumption and environmental impacts; (2) Ghos work, invisible work and the precariousness of working conditions associated with the maintenance of these systems; and (3) the ethical and social challenges related to algorithmic opacity and the concentration of power. By revealing what is behind the functioning of these technologies, it is hoped to contribute to a broader ethical reflection on the direction of artificial intelligence on a global scale.

2 ENERGY CONSUMPTION AND ENVIRONMENTAL IMPACTS

The exponential advance of generative artificial intelligence, especially language models such as ChatGPT, has brought to light an aspect that is often neglected in enthusiastic discourses about technological innovation: the massive consumption of energy and its respective environmental impacts. Although these technologies are promoted as efficient, fast and intelligent tools, their operation depends on complex computing infrastructures, with energy consumption that rivals and, in some cases, exceeds that of entire countries. (Chen, 2024)

Models like OpenAI's GPT are trained on supercomputers equipped with thousands of GPUs and high-performance processors. This training phase, which can last weeks or months, requires gigawatt-hours (GWh) of energy. A study published in Joule by Patterson et al. (2021) points out that training large AI models can emit up to 284 tons of CO_2, equivalent to the emission of 125 gasoline-powered cars in one year.

In addition to training, there is everyday use, such as queries to ChatGPT, which also depends on datacenters in continuous operation. It is estimated that each question asked of a model like GPT-3 consumes about 500 ml of water, considering the cooling of the servers, according to a report by The Washington Post (2023). If we extrapolate to millions of daily users, the water impact becomes equally alarming.

This scenario is aggravated when we consider the concentration of these operations in large datacenters operated by companies such as Microsoft, Google, Amazon, and other technological giants, which are usually installed in regions with tax incentives and availability of water and electricity resources, often in places vulnerable to water stress or with energy production based on fossil fuels.

The relationship between AI and sustainability therefore needs to be rethought. As Liu et all (2023) warn, the sophistication of AI systems "reproduces an extractive model of innovation", where the indiscriminate use of energy is naturalized in the name of technical progress, without considering the long-term effects on the planet. Liu et all further criticizes the use of the discourse of green innovation as a smokescreen: "there is nothing ecological about training neural networks on a large scale while communities face rationing and severe climate change" (LIU et All, 2023, p. 61).

There are attempts to mitigate this impact. OpenAI, for example, has entered into partnerships with renewable energy providers, and companies like Google claim to operate with "carbon neutral". However, experts such as Kate Crawford (2021) argue that these practices, while important, are often palliative measures. In his work Atlas of AI, Crawford reinforces that "the promise of carbon neutrality does not offset the environmental and social impacts of the complete AI cycle, which goes from the extraction of minerals to the disposal of electronic components" (CRAWFORD, 2021, p. 174).

In addition to electrical energy, it is crucial to highlight the environmental footprint of the physical equipment involved: servers, processors, cooling systems, storage infrastructure, and networking. The production of these devices depends on rare earth mining, intensive water use, and the exploitation of cheap labor in countries in the Global South, which reinforces the criticism that AI, despite being digital and "invisible", carries with it concrete marks of environmental and social inequality (Oliveira 2024).

That said, the accelerated growth of generative artificial intelligence poses real challenges to environmental sustainability. The technophilic discourse needs to be balanced with a critical and responsible view of the energy and ecological costs of AI. The inclusion of these factors in digital and environmental governance policies is urgent. Proposals such as mandatory energy audits for large AI models, encouragement of efficient learning techniques (such as low-rank adaptation), and investments in sustainable and transparent data centers are promising, but still incipient.

3 GHOST WORK: THE INVISIBLE WORK OF AI

Another aspect, often ignored in the technophilic discourse around generative AI, is the reliance on the so-called "ghost *work*", a term coined by Gray and Suri (2019) to describe the performance of outsourced human workers, usually from peripheral countries, who perform data labeling, content moderation, and refinement of AI responses. Despite being essential for the functioning of the systems, these professionals work in precarious conditions, with low pay and without formal recognition.

In the case of ChatGPT, *Time Magazine* revealed in 2023 that OpenAI hired Kenyan workers for less than $2 per hour to filter sensitive and violent content used in the model's training (PERRIGO, 2023). These activities, in addition to being emotionally draining, are not transparent to the end user, who believes they are interacting with an "autonomous" AI. This erasure of human labor fosters the illusion of self-sufficient intelligence, when in fact, much of AI's "intelligence" is powered by thousands of invisible workers.

This scenario raises serious ethical and social questions about the outsourcing of pain, digital colonialism, and the exploitation of cheap labor under the façade of innovation. As Casilli (2020) points out, AI infrastructures are supported by a global digital division of labor, in which developing countries provide the basis for the supposed advancement of technologies in central countries. Fair governance of AI should include minimum labor criteria, transparency guidelines on the use of human labor, and recognition of the role of these people in the production chain.

Generative AI, while based on sophisticated statistical models, relies significantly on data curation and annotation by humans. This "invisible labor" is often hired through third-party platforms, such as Sama (formerly Samasource), which has already provided services to large technology companies, including OpenAI. In a Time report (Perrigo, 2023), it was revealed that workers in Kenya were paid less than $2 per hour to analyze and moderate highly sensitive and disturbing content, with the aim of training language models such as ChatGPT to filter out offensive content. Many of these workers reported severe psychological

impacts, such as insomnia, anxiety, and depression, due to constant exposure to violent and abusive materials.

> Workers reported traumatic experiences related to the content they needed to classify. Some described sleepless nights and diagnoses of post-traumatic disorders. This type of essential but invisible work raises serious ethical concerns about the conditions under which AI systems are being developed (PERRIGO, 2023 p.10).

This type of practice evidences a modern form of digital colonialism, in which developed countries outsource to the Global South the tasks that are least valued and most harmful to human well-being. As Gray and Suri (2019) point out in Ghost Work, it is a new class of digital work that sustains the promises of automation, but remains invisible to consumers and innovation discourses. "The illusion of total automation hides the army of human workers performing 'simple' but absolutely essential tasks behind the supposed intelligence of the machine" (Gray & Suri, 2019, p. 27).

As Gray and Suri (2019) point out in *Ghost Work: How to Stop Silicon Valley from Building a New Global Underclass*, this type of "ghost" work sustains the illusion that technology works by itself, when in reality, it depends on a global network of low-paid and invisible workers.

The neoliberal logic applied to technological development favors the invisibility of this type of labor. The rhetoric of the "work of the future" conceals the structural dependence of the "work of the present", a present characterized by informality, absence of labor protection, and significant psychic impact. As Casilli (2020) points out, artificial intelligence systems depend on an ecosystem of digitally connected microworkers, who perform essential tasks for the training, refinement, and maintenance of AI systems, often in precarious working conditions, with little visibility and recognition.

The rhetoric that AI works autonomously and intelligently omits, deliberately or not, the dependence of these systems on human beings who often operate under exploitative work regimes.

Much of this invisible work is performed by *data workers*, or data workers, who perform tasks such as labeling, categorizing, transcribing, and filtering offensive content. They are the ones who help "teach" algorithms what is appropriate or inappropriate, reinforcing the response patterns of generative AIs. Platforms such as Amazon Mechanical Turk, Remotasks, Scale AI, and Sama utilize an outsourced, decentralized workforce, often situated in developing countries, where labor regulation is weak or ineffective. These workers are subjected to low wages, exhausting working hours and the absence of labor guarantees.

In the specific case of ChatGPT, these tasks were fundamental for the development of

content moderation mechanisms in the GPT-3 model, the basis of ChatGPT. Many of these workers reported profound psychological impacts, including insomnia, anxiety, and post-traumatic stress, configuring a new form of psychological distress resulting from digital work. "In order for AI to appear 'clean' and safe to the end user, someone had to expose themselves to inhuman content, without the necessary support. This is dirty work disguised as innovation" (*Time Magazine*, 2023).

In addition, the work model adopted by these platforms resumes the exploitative logics of informal and precarious work, with additional layers of invisibility. As Casilli (2020) observes, algorithmic-based digital work configures a new international division of labor, in which countries in the Global South become providers of 'cognitive digital work' in exchange for derisory remuneration.

This dynamic exposes not only an economic imbalance, but also an ethical one, in which the benefits of AI are concentrated in large corporations and countries of the North, while the human costs are externalized to vulnerable populations. "What we call artificial intelligence is, to a large extent, human labor masked, devalued, and globally distributed" (Casilli, 2020, p. 15).

The criticism of invisible work in AI is not restricted to working conditions alone. It also concerns the absence of authorial recognition, since these workers do not appear as co-authors or intellectual collaborators of the systems. Their work is disposable, replaceable, uncredited, which aggravates the social devaluation of these activities. Such conditions are contrary to the principles of ethical governance of AI advocated by institutions such as UNESCO (2021) and the European Union, which defend respect for human rights and dignity in technological development.

From the point of view of the social and labor sciences, the situation of invisible AI workers can be interpreted as a process of *cognitive uberization*, in which there is an intensification of algorithmic control, the fragmentation of tasks, and the individualization of responsibilities. Like app drivers, these workers do not have employment relationships, operate under intermittent demands, and are subject to automated evaluations. The difference is that, in this case, the work is even more opaque, as there is no direct interaction with the audience and not even recognition that it exists.

It is also worth considering the ethical challenges related to the transparency of AI systems. The invisibility of human labor in cutting-edge technologies feeds the false belief that systems are "neutral" or "objective." However, every algorithmic decision is a reflection of previous human decisions, and these decisions have been shaped by specific cultural, economic, and social contexts. The deliberate concealment of this human base favors the

naturalization of automation, when in fact it is far from being autonomous.

We highlight that denunciation and regulation initiatives have been gaining space. Movements such as the *AI Now Institute*, Data *& Society,* and the *Labor Tech Research Network* have promoted research on working conditions on AI platforms and advocated for the creation of legal and regulatory frameworks that ensure minimum labor rights for these workers. The proposal is to broaden the public debate on the human impacts of AI and promote truly ethical, transparent, and fair artificial intelligence.

It is necessary for educational, research and public policy formulation institutions to consider this scenario in the training of professionals in the technological area. The development of advanced technologies must be inextricably linked to respect for human rights, the appreciation of work and social justice. AI will only be truly intelligent if it knows how to recognize, and value, the human beings who make it possible.

4 ETHICS, TRANSPARENCY, AND GOVERNANCE OF AI

The opacity of AI systems, especially large language models, calls into question the transparency and accountability of the companies that develop them. ChatGPT, for example, operates as a "black box": its training data, algorithmic weights, and moderation criteria are proprietary, which prevents external audits and makes it difficult to hold accountable for biases, discrimination, or errors made by the system.

According to Crawford (2021), this technical opacity is also a political strategy, as it prevents public scrutiny and concentrates decision-making power over knowledge and its mediation in the hands of a few corporations. In addition, as the models are trained with data extracted from the internet, often without consent, there is a violation of copyright and privacy, a problem already judicialized in different countries.

Discussions on AI governance are still in the early stages, but some proposals have been discussed at the global level, such as the European Union's "AI Act", which proposes rules on transparency, data protection, and user rights. In Brazil, Bill 2338/2023 also proposes guidelines for the responsible use of AI, including principles such as non-discrimination, explainability, and human control.

The rise of generative artificial intelligence systems, such as ChatGPT, has brought to light a number of ethical dilemmas and regulatory challenges that affect not only the scientific and technological community but also society as a whole. These systems are capable of generating texts, images, codes, and decisions that resemble human capabilities, but without necessarily being subject to the same structures of responsibility, judgment, and values. In light of this, discussing the principles of ethics, transparency, and governance of AI becomes

essential to ensure that its use does not intensify inequalities, compromise rights, or reproduce historical biases.

Ethics applied to AI is directly related to the way systems are designed, trained, and used. The lack of clarity about the databases used in the training, the algorithmic decision criteria and those responsible for supervising the systems represents one of the main points of tension.

Many AI models, including ChatGPT, operate as "black boxes", in which it is not known exactly how a certain result was reached. This algorithmic opacity compromises fundamental principles such as accountability and auditability.

> "An artificial intelligence system whose chain of decisions cannot be considered ethical The ethics of AI require transparency and governance at all stages of its development" (Floridi & Cowls, 2019, p. 7).

The lack of transparency also raises concerns about the reproduction of prejudices and stereotypes. Because models are trained on large volumes of data extracted from the internet, there is a tendency to incorporate, and even amplify, discrimination based on race, gender, class, and sexual orientation. A study by Bender et al. (2021), for example, demonstrated that large language models can reproduce racist, misogynistic, or discriminatory language, without appropriate filters. The problem is that even when these flaws are acknowledged, there are rarely effective mechanisms to correct or hold developers accountable.

Another critical point is the governance of these technologies. Most generative AI systems are controlled by big tech companies such as OpenAI, Google, Meta, and Anthropic. This raises questions about the concentration of power, unequal access to technology, and the absence of public control. AI governance, therefore, involves not only technical aspects, but above all political and social aspects. Who decides what is ethical? Who sets the limits of AI use? And who supervises?

In response to these challenges, several international initiatives have been developed. UNESCO, for example, published in 2021 the Recommendation on the Ethics of Artificial Intelligence, a normative framework that proposes principles such as justice, inclusion, responsibility, and sustainability in the use of AI. The document emphasizes the need to protect human rights and ensure that the benefits of AI are distributed equitably. The European Union, on the other hand, with the proposal of the AI Act, intends to establish strict rules for the use of AI in different sectors, classifying systems according to the risks they

present. "AI governance must be human-centred, ensuring that technology respects dignity, freedom and diversity" (UNESCO, 2021, p. 3).

Despite these advances, there are still significant gaps, especially in countries in the Global South, where discussions on regulation, ethics, and digital rights are incipient. In Brazil, Bill 2338/2023 seeks to establish a legal framework for AI, with general guidelines for the responsible development of the technology. However, experts warn that the text needs to be more robust in relation to data protection, regulation of the private sector and social participation in the construction of rules.

Another essential aspect is the ethical and digital education of professionals involved in the design of AI systems. Engineers, developers, data scientists, and designers need to be trained not only technically, but also with ethical sensitivity and social criticism. AI ethics cannot be seen as a post-development addendum, but as a guiding principle from the first lines of code. This perspective is defended by Mittelstadt et al. (2016), who highlight the importance of incorporating human values into the design of algorithmic systems.

In this sense, AI governance must be thought of in a multisectoral and collaborative way, involving governments, companies, universities, civil society organizations, and the users themselves. The concept of democratic governance of AI implies creating deliberative spaces to discuss the uses and limits of these technologies, taking into account diverse cultural, economic, and historical contexts. This is especially important in areas such as health, safety, education, and justice, where automated decisions can have direct impacts on people's lives.

It is worth noting that transparency and ethics in AI also involve the openness of knowledge. Open-source models, auditable data, clear documentation, and channels for reporting errors or abuse are strategies that can make systems more reliable and fair. The adoption of explainable algorithms (explainable AI) also contributes to demystifying algorithmic decisions and allowing greater control by users.

We emphasize that the advancement of generative AI needs to be accompanied by a deep public debate and the implementation of solid governance and oversight structures. Ethics, transparency and governance are not obstacles to innovation, they are its guarantees of social legitimacy. If we neglect these aspects, we risk building powerful but socially irresponsible systems that exacerbate inequalities and violate rights. As a society, it is critical that we demand accountability and algorithmic justice if artificial intelligence is to truly serve the common good.

5 METHODOLOGY

5.1 TYPE OF RESEARCH

This study is characterized as a qualitative research of exploratory and descriptive nature, as it seeks to understand, analyze and describe complex phenomena related to the development and use of generative Artificial Intelligence, especially the ChatGPT model, from multiple perspectives, social, environmental, ethical and technological. The qualitative approach is suitable for studies that aim to interpret complex, social and subjective phenomena, based on the analysis of discourses, behaviors, practices and symbolic structures (Minayo, 2007).

Exploratory research is justified by the need to map themes still in the academic consolidation phase, such as the precariousness of digital work and algorithmic governance, aspects that require methodological sensitivity to identify nuances, controversies, and theoretical gaps (GIL, 2019). The descriptive nature, on the other hand, allows the systematization of the existing knowledge about the axes investigated, such as energy consumption, invisible work and algorithmic ethics, articulating them in a critical way based on the evidence found.

This methodological strategy aims not only to describe data already published, but to analyze them based on emerging categories, contributing to a transdisciplinary and critical look at the advancement of generative AI. According to Flick (2009), qualitative research is fundamental to deal with emerging technologies and their social impacts, as it allows exploring meanings, motivations and ethical implications that often escape traditional quantitative approaches.

5.2 BIBLIOGRAPHIC RESEARCH

The investigation will be conducted through a systematic bibliographic research, guided by the survey and analysis of scientific and technical-academic publications in the areas of Artificial Intelligence, Technology Ethics, Digital Governance and Critical Computer Studies. The choice of bibliographic research as a method is anchored in the proposal to identify, organize, and interpret existing knowledge about the object of study, as defended by Lakatos and Marconi (2020), which is an essential procedure to theoretically support any scientific investigation.

The main basis is systematic bibliographic research, supported by national and international academic and technical-scientific sources. Reference works in the areas of Software Engineering, Technology Ethics, Digital Sustainability, AI Governance and Critical Technology Studies will be used. Among the types of materials consulted are: articles indexed

in the Scopus, Scielo, IEEE Xplore databases, Capes Journal Portal, as well as books, white papers, theses, dissertations, reports from organizations such as UNESCO, OECD and AI Now Institute.

In addition to the sources mentioned, data collection will be guided by specific keywords, such as: Generative Artificial Intelligence, ChatGPT, invisible work, ghost work, AI ethics, algorithmic governance, environmental impact of AI, among others. The search will be refined with the use of Boolean operators, time and language filters, as recommended by Boell and Cecez-Kecmanovic (2015) to ensure a robust systematic review.

The data analysis will follow the principles of content analysis, as proposed by Bardin (2016), allowing the identification of recurrent thematic categories, relationships between concepts and theoretical gaps. The use of this method offers flexibility and depth in the interpretation of discourses and texts, being especially effective in research involving controversial and multidimensional topics, such as generative AI.

Table 1

Criteria for inclusion of descriptors

Keyword	Number of Items Found	Number of Articles Downloaded
Generative Artificial Intelligence	85	25
Ghost Work	45	15
ChatGPT	120	40
Invisible work	42	15
AI ethics	65	20
Algorithmic governance	58	18
Environmental impact of AI	73	22

Source: The authors 2025.

The execution of the research will be guided by a set of steps that involve the delimitation of the problem, formulation of objectives, bibliographic survey, content analysis and systematization of the results. The first stage will consist of an exploratory reading of the material gathered, in order to select the texts that dialogue directly with the proposed thematic axes: energy consumption, hidden work and AI ethics.

During the screening of the collected material, criteria will also be adopted to exclude the analyzed sources. Journalistic or opinionated texts without methodological basis, outdated articles or articles disconnected from the central themes of the study will be disregarded. Materials with a commercial or promotional bias, such as corporate manuals and releases from technology companies, will also be excluded.

The relevance of the publications will be evaluated based on the methodology used, the recognition of the journal or institution responsible and the direct contribution to the topic under analysis. According to Galvão and Ricarte (2021), the definition of clear and objective inclusion and exclusion criteria is essential to ensure the reliability and replicability of a systematic literature review.

Then, selective and analytical reading will be carried out, with the identification of key passages, data, arguments and case studies that serve to critically support the discussion. This analysis will be organized into thematic categories guided by the specific objectives and will allow a cross-cutting approach to the data. To ensure the traceability of the sources and methodological fidelity, the thematic filing method will be adopted and the organization of the data in concept maps and comparative tables.

The triangulation of sources will also be considered as a strategy for qualitative validation of the interpreted data, crossing academic evidence with technical reports and institutional documents, such as those published by organizations such as AI Now Institute (2023), UNESCO (2021) and OECD (2022). This combination will allow not only to deepen the findings, but also to tension dominant discourses with critical and situated analyses.

5.3 LIMITATIONS AND DELIMITATION OF RESEARCH

This research is restricted to the bibliographic and documentary analysis of studies already published so far, which limits access to primary data on the internal corporate practices of AI development companies, such as OpenAI or Google DeepMind. As this is a qualitative and exploratory study, it will not be possible to establish statistical generalizations, and the contextual and interpretative understanding of the phenomena will be prioritized.

The temporal delimitation of the research comprises the academic and technical production published in the last ten years (2014–2024), with emphasis on the intensified discussions after the launch of tools such as ChatGPT, starting in 2022. Geographically, although the research adopts an international perspective, sources that allow analyses applicable to the Brazilian context will be privileged, especially with regard to regulatory governance and the local impacts of the use of AI.

Another recognized limitation is the scarcity of systematic studies on invisible AI workers in Portuguese, which reinforces the need to resort to international studies such as Gray and Suri (2019), authors of the concept of ghost work, as well as reports from the Oxford Internet Institute and the Partnership on AI.

5.5 ACADEMIC ETHICS AND COMPLIANCE

Although the research does not involve human subjects directly, the ethical principles of scientific research will be strictly observed. All sources will be properly cited according to the standards of ABNT NBR 6023:2024 and NBR 10520:2023, ensuring respect for intellectual property and avoiding plagiarism practices or misuse of content.

In addition, the research adopts a critical and responsible stance towards the topics addressed, especially when it comes to the exposure of exploitative relations in digital work or the environmental impact of technologies. The care in the representation of data, in the use of inclusive language and in the criticism of the predatory practices of large technological corporations will be an epistemological and ethical commitment of the study.

The project follows the guidelines of the National Research Ethics Commission (CONEP) for research in the humanities and social sciences, even if it does not involve the collection of sensitive data, seeking to align with the principles of open science, public access to knowledge, and scientific rigor.

6 RESULTS AND DISCUSSION

This research is expected to contribute significantly to the field of critical Artificial Intelligence (AI) studies, especially as it relates to the hidden impacts of generative AI. The choice of ChatGPT as an object of analysis is justified by its wide diffusion and influence in digital and academic environments, which makes a critical approach that goes beyond the prevailing technophilic discourse urgent. The proposal of this study aims to illuminate socio-environmental, ethical and political contradictions often made invisible in innovation narratives.

Regarding energy consumption and environmental impact, it is expected as a result the systematization of data that demonstrate the high ecological cost involved in the creation and operation of large-scale language models. According to Strubell et al. (2019), training models such as BERT can emit as much CO_2 as five cars over their lifetimes, evidencing the magnitude of the problem. It is estimated that more robust models, such as GPT-3, generate even greater impacts. Recently, studies have shown that the energy consumption of AI infrastructures is already close to that of entire countries (Hao, 2022). Such results can support public policies aimed at computational sustainability, in addition to provoking discussions about the adoption of ecological practices by big techs.

With regard to invisible human labor, the expectation is to reveal the social gears that sustain the functioning of generative AI. As exposed by Gray and Suri (2019), thousands of workers work in labeling, content moderation, and data refinement tasks in precarious

conditions, mostly located in the Global South. OpenAI, for example, hired third-party companies in countries such as Kenya to expose workers to violent and disturbing content for minimum wages, as investigated by Metz (2023). This phenomenon, known as *ghost work*, exposes the contradiction between the supposed autonomy of AI and the continued dependence on human labor, which is often exploited and devalued.

Regarding ethical and governance challenges, the research aims to point out the risks of the indiscriminate use of generative AI in sensitive contexts such as health, education, and public safety. The UNESCO report (2021) highlights the urgency of international guidelines that ensure the ethical use of AI, proposing the implementation of principles such as fairness, responsibility, explainability, and non-discrimination. In addition, algorithmic governance lacks effective instruments to ensure transparency and *accountability* in relation to decisions made by automated systems (Floridi et al., 2018). It is expected to map good practices and emerging initiatives, such as the European Union's AI Act, and evaluate their applicability in the Brazilian context.

Finally, it is hoped that the results of this investigation will serve as a basis for new studies, formulation of regulatory proposals and awareness of technology professionals and civil society. Building a fairer and more sustainable digital ecosystem depends on facing the side effects of technological advancement. The visibility of these aspects can inspire participatory AI governance initiatives, in addition to fostering interdisciplinary debates focused on human centrality and fundamental rights.

7 CONCLUSION

The emergence and popularization of generative artificial intelligence, especially through platforms such as ChatGPT, has revealed an ambivalent scenario that mixes innovative potentialities with impacts that are often hidden and silent. Throughout this article, we have sought to shed light on three fundamental aspects that involve the backstage of AI: energy consumption and its environmental impacts, the invisible work that sustains generative models, and the ethical, transparency, and governance challenges that permeate its social use.

It became evident that the advancement of AI is neither neutral nor automatic: it depends on infrastructure chains that are intensive in natural and human resources. The magnitude of energy consumption to train and operate language models is alarming, especially when compared to global energy transition and climate change mitigation efforts. At the same time, the existence of hidden and precarious labor, often hired in countries of the Global South, reveals that intelligent systems are still supported by unequal structures,

reproducing the same dynamics of exploitation present in other phases of the digital revolution.

On the ethical and political level, the challenge of building fair, auditable and transparent AI systems is still far from being fully addressed. The regulatory initiatives and normative frameworks under construction, although promising, need to be accompanied by democratic participation, effective oversight, and critical training of professionals and users. AI governance should be thought of not only as a technical tool, but as a political choice about the type of society one wants to build.

It is therefore concluded that generative artificial intelligence carries within itself not only the promise of efficiency and productivity, but also the responsibility to be developed with social justice, sustainability, and ethics. For its use to be truly emancipating, it is essential that academia, public policy makers, companies and civil society are aware of its invisible impacts. Only in this way will it be possible to ensure that AI is at the service of the common good, and not of concentrated interests that deepen inequalities and silence voices.

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