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Research Article

A Systematic Review of the State-of-the-Art of Green IT and Green Software from 2020

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ABSTRACT

This article provides a systematic literature review (SLR) on green technologies, specifically Green Information Technology (Green IT) and Green Software, and their role in environmental sustainability. It highlights the growing concern about the energy consumption impact of Information and Communication Technologies (ICT), which currently accounts for 7% of global greenhouse gas emissions and could double by 2025. This review includes 268 studies from before 2020 to 2024. Emerging technologies such as blockchain, 5G, 6G, and Big Data Streaming, and their theoretical potential to mitigate their energy consumption impact, are identified and analyzed. The results indicate a strong trend towards the adoption of Green IT technologies, due to their holistic approach encompassing both hardware and software to reduce environmental impact. Furthermore, the importance of smart cities, IoT devices and cryptographic technologies in this context is underlined. Finally, it is concluded that further research in these areas is essential to develop new sustainable technologies and improve the quality of life of future generations.

Keywords: Green IT, Green Software, Sustainability.

1. Introduction

The environmental impact of **Information and Communication Technologies (ICTs)** has become a growing concern, contributing approximately **4% of global greenhouse gas emissions**, surpassing those from the aviation sector. If current trends continue, ICT-related emissions are projected to **double by 2025**, reaching levels comparable to those produced by the entire automotive industry [1].

In response to this **rising environmental impact**, several **international initiatives** have been introduced to encourage **sustainable technological practices**. The **United Nations' Sustainable Development Goals (SDGs)**, particularly **Goal 9 (Industry, Innovation, and Infrastructure)** and **Goal 12 (Responsible Consumption and Production)**, highlight the importance of **energy-efficient technologies** and a transition toward sustainable digital solutions [156]. Green IT and Green Software are key pillars in achieving these objectives, aiming to **reduce energy consumption, optimize computational resources, and minimize the environmental footprint of digital infrastructures**.

Over the past few years, **Green IT initiatives** have focused on **enhancing energy efficiency** in data centers, cloud computing, and IoT infrastructures. Meanwhile, research in **Green Software** has explored **optimization algorithms, AI-driven efficiency models, and low-power programming techniques**. However, despite these advancements, there is still **no standardized framework** to assess the impact of Green Software, nor a unified agreement on best practices for its implementation.

Artificial Intelligence and Green IT: A Sustainable Approach

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Emerging technologies such as **Artificial Intelligence (AI)** play a pivotal role in advancing **Green IT solutions**. Recent studies have demonstrated how AI-based **predictive models** can **optimize server resource allocation**, **reduce power consumption in data centers**, and **enhance intelligent cooling systems** [157]. Furthermore, **machine learning techniques** are increasingly being applied to **predict and minimize software-related energy costs**, making **Green AI** a promising field for future research [158].

Research Questions

This paper aims to address the following research questions:

- **Q1:** What are the previous contributions related to Green Computing in software development?
- **Q2:** What are the main concepts currently being researched in the development of Green Software technologies?
- **Q3:** What are the future contributions that can enhance sustainability in Green Computing through Green Software?

To answer these questions, a **Systematic Literature Review (SLR)** was conducted, identifying **key trends, research gaps, and potential advancements** in the field. The findings will help **align Green IT research with international sustainability standards**, contributing to the development of a **more energy-efficient and environmentally friendly digital ecosystem**.

The main intention of the systematic literature review (SLR) mentioned in the paper is to classify and analyze recent contributions related to green technologies (Green IT and Green Software). This classification allows:

Identify current trends and developments: Show the state of the art in sustainable technologies, highlighting key concepts such as sustainability, Green IT and Green Software.

Evaluate areas with less development: Find gaps in research and issues not sufficiently explored, such as the lack of standardized methodologies to assess the adoption of green software practices.

Provide guidelines for the future: Propose new research opportunities based on emerging technologies such as artificial intelligence, blockchain, IoT and their applications in sustainability.

Promote the adoption of sustainable practices: Highlight the importance of combining efficient hardware and software to reduce the carbon footprint and environmental impact of TICs.

This work is divided into the following sections: in Section 1 the context of the research is exposed, detailing the research questions; to continue with Section 2 we have concepts associated with the research, Sustainability, Green IT, Green Software, in Section 3 we find the related works to the research, Section 4 details the methodology of the systematic literature review, to give way in Section 5 the classification of the works analyzed, to detail in Section 6t the most relevant works according to the classification, Section 7 discussed the results, and Section 8 presents the conclusions and future work.

2. Background

2.1 Theorical Framework

In this section, we will discuss the main analyzed concepts for the development of the systematic review of literature.

2.1.1 Sustainability

Based on an elementary principle for guidance of human activities, it guarantees the compliance of actual needs without compromising the ability to meet the needs of future generations. Within the scope of environmental, it refers to the ability to maintain an ecological balance and conserve natural resources for future generations.

To compliance with this purpose, the impact on the used resources must be minimized, thus reducing the generated pollution and protecting the biodiversity of ecosystems.

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The use of electricity in high proportions demands the use of other non-renewable materials such as gas, and coal, among other elements that are increasingly scare, causing a significant alteration of the geography. But above all, generating high CO2 emissions, which not only pollute the air but also affect the ozone layer and therefore alter climate stability. This is in full agreement with the statements that humans live on a finite planet, that is, that they have non-renewable resources and the speed with which they are being exploited represents a serious threat to permanence on earth. [2]

2.1.2 Green IT

Referring to the responsible and sustainable use of information and communication technologies (ITCs), Green IT encompasses all branches related to informatic development with the aim of adopting practices that reduce energy consumption, waste of resources and carbon emissions associated with the use of technology to minimize environmental impact.

Green IT's initiatives include virtualization servers to optimize resource use, deploying efficient hardware energy from an energetic view, effectively managing the lifecycle of electronic devices, and promoting remote work to reduce travel and related greenhouse gas emissions [1].

Given the relevance of environmental sustainability in the execution of IT processes, the question is how through the application of a low cost and easy to implement strategic plan the use of resources, services and business processes is faced, ensuring sustainability and interoperability in its operations and actors from a green perspective. Curay (2019) indicates that strategic planning structures opportunities and threats, and delimits the strengths and weakness that arise, in such a way that they are support for decision making and the achievement of action plans in the medium and long term. [3]

2.1.3 Green Software

"Green Software" refers to the practice of developing environmentally sustainable software, which minimizes the consumption of resources as defined by the teacher of Mathematics and Artificial Intelligence at the School of Engineering of the Pontificia Comillas David Contreras University. It focuses only on the development and use of software in a sustainable way, Green Software seeks to write efficient code that consumes fewer computational resources, optimization algorithms, and processes to reduce the carbon footprint associated with the execution of programs and encourage eco-efficient practices to mitigate the environmental impact of digital technology by optimizing software in all its stages, from development to deployment and continues use.

Green mining has fascinated researchers to propose solutions on how to reduce energy use (Morales et al., 2018). Initially, researchers working in the field of green IT focused primarily on improvising hardware design to reduce energy use, but recently researchers have successfully demonstrated that software design can make a significant contribution to achieving this goal.[4]

3. Related Works

In this section, we detailed the works related to this systematic review, considering that concepts associated with sustainability and Green IT, in recent times, gained strength in recent times.

Metrics and impact evaluation

The authors in [7] offer theoretical basics to contextualize the technologies that address energy efficiency through the human factor, considering sustainability and the lack of systematic processes in technology development to promote sustainable behavioral changes. However, their study does not consider concepts directly related to Green IT.

The authors in [16] define a material measurement monitoring system based on computer vision for more sustainable manufacturing. However, their study does not provide evidence of its alignment with Green Software.

Use of AI in Green IT

The authors in [17] discuss the use of artificial intelligence (AI) technologies in urban planning, particularly in urban data analysis, infrastructure management, urban monitoring, and environmental management. They highlight AI's

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potential to optimize resource usage and improve energy efficiency in cities, although Green IT is not considered in their study.

The authors in [40] present a review of machine learning methods for predicting occupancy patterns in building systems, with a focus on energy efficiency, indoor air quality, and thermal comfort. While their research explores energy efficiency, it does not directly focus on Green Software.

Sustainable Infrastructure and Energy Optimization

The authors in [30] discuss how Fog Computing Technology combined with 5G can be leveraged for sustainable infrastructure development in smart cities. However, their study does not focus directly on sustainability issues.

The authors in [48] analyze the applicability of blockchain technology in Smart Grid 2.0, aiming to facilitate a smooth decentralization process. Although they review distributed energy resources (DERs), blockchain-based applications, and integration challenges, they do not specifically address Green IT or Green Software.

The authors in [52] explore methods for improving the efficiency of thermal storage embedded energy systems (TES), comparing two optimization approaches: genetic algorithms (GA) and particle swarm optimization (PSO). While the study focuses on Green IT through intelligent control systems in embedded systems, it does not address Green Software.

Emerging Technologies in Green IT

The authors in [66] discuss cloud-based IoT communication, focusing on real-time security challenges. They examine the layered architecture of fog-based IoT networks alongside the performance of IoT applications operating within cloud computing paradigms but do not focus on Green IT.

The authors in [83] provide a comprehensive review of the application of artificial intelligence in the construction industry, identifying AI technologies, their potential benefits, and challenges in adoption. However, they do not focus on Green Software or sustainability.

The authors in [113] examine how the combination of AI, the Internet of Things (IoT), and cloud computing can ease companies' transition toward sustainable practices by focusing on creating environmentally friendly business processes that improve resource usage and reduce environmental impact.

The literature on Green IT and Green Software has expanded significantly in recent years. This section reviews relevant studies grouped into four key categories:

- Energy efficiency and impact assessment.
- Use of AI in Green IT
- Sustainable infrastructure and optimization
- Emerging technologies in Green IT

To provide a clearer comparison, Table 1, summarizes the key aspects of the reviewed studies, highlighting their main contributions and areas of focus.

Table 1: Comparative Summary of Related Work

Reference	Focus Area	Main Contribution	Green IT	Green Software	AI in Sustainability
[7]	Energy Efficiency	Theoretical framework for sustainability in ICT	X		

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[16]	Impact Assessment	Computer vision for sustainable manufacturing	X		X
[40]	AI for Energy Mgmt.	ML models for predicting energy consumption	X		X
[52]	Optimization Methods	GA & PSO for improving energy systems	X		X
[66]	Cloud & IoT Security	Security in cloud-based IoT communication	X		
[92]	Green Software Dev.	Sustainable coding practices in cloud apps		X	
[113]	AI & Green Software	AI, IoT & cloud computing for sustainability	X	X	X
[145]	Green AI	AI optimization to reduce energy footprint	X	X	X

As shown in Table 1, most studies focus on Green IT, while Green Software remains a relatively less explored research area. Additionally, AI is increasingly being incorporated into sustainability-oriented technologies, but there is still a lack of standardized methodologies for assessing its real impact.

4. Methodology of the systematic review of the literature

To conduct this review and answer the proposed research questions, the systematic literature review method (SRL) proposed by Kitchenham [112] was used. An SLR is a structured and rigorous approach to identifying, evaluating, and synthesizing existing research related to a specific topic. It follows predefined criteria to ensure objectivity and comprehensiveness, which helps minimize bias in the selection and interpretation of studies. The guide was used as a strategy to identify the most relevant scientific contributions to the development of green computing.

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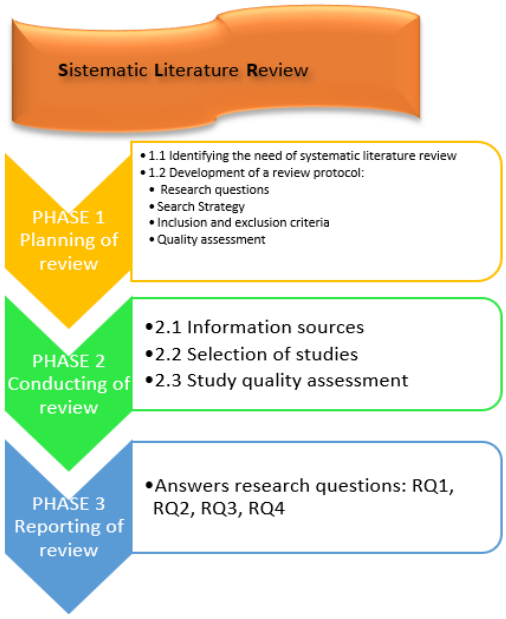

Figure 1. Flow chart based on Kitchenham procedure [112].

4.1 Materials and methods

The guidelines indicated by Kitchenham in her guide made it possible to summarize all the existing information on the objective of the research, being an exhaustive and impartial search.

The search process for relevant articles was carried out in the digital database repositories of Google Academic, Science Direct, IEEE Xplore Digital Library as can be seen in **Table 2** and the percentages are also in **Figure 2**. Keywords and synonyms were used in the title, abstract and content of the articles, these words were used in the English language and were: "Green Information Technology with its synonyms Green IT", "Green Computing, "Green Software, "software; definition with its synonyms: "concept", "feature y challenge"; and finally, "pollution" as it is a systematic review we focused on the word review.

Table 2. Classification of selected articles by the used databases

Data Base	Reference
Google Scholar	[5] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [41] [62] [63] [64] [65] [66] [67] [68] [69] [70] [71] [72] [73] [74] [75] [76] [77] [78] [79] [80] [81] [82] [83] [84] [85] [86] [92] [93] [94] [95] [96] [97] [98] [99] [100] [101] [102] [103] [109] [113] [114] [115] [116] [117] [125] [126] [127] [128] [129] [130] [131] [138] [139] [140] [141] [142] [143] [149] [150] [151] [152] [153]
IEEE	[6] [7] [8] [42] [43] [44] [45] [46] [61] [88] [89] [106] [107] [108] [110] [111] [118] [119] [132] [144]
Science Direct	[9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [40] [47] [48] [49] [50] [51] [52] [53] [54] [55] [56] [57] [58] [59] [60] [87] [90] [91] [104] [105] [120] [121] [122] [123] [124] [133] [134] [135] [136] [137] [145] [146] [147] [148] [154] [155]

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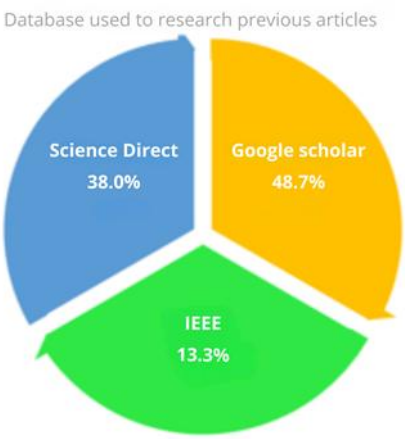

Figure 2. Percentage of articles found in the databases used.

4.2 Search Strategy

With these keywords, 4 logical expressions were developed to be evaluated from 2018 to 2024; the reason for using 4 logical expressions is due to the variety of terms with which they refer for research or development of green technologies. The logical expressions were:

- (Green Information Technology AND (software and definition OR concept OR feature OR challenge OR pollution)) AND review
- Green Information Technology AND (software AND (definition OR concept OR feature OR challenge OR pollution)) AND review
- Green Computing AND (software AND review AND (definition OR concept OR feature OR challenge OR pollution))
- Green Information Technology AND (green software AND (definition OR concept OR feature OR challenge OR pollution)) and review

Once the logical expressions were evaluated, 228 related research papers were obtained as initial search results.

4.3 Inclusion criteria

To reduce the number of papers because of the initial search, the following inclusion criteria were used:

- Scientific articles published in journals.
- Publications in English or Spanish.
- Publications produced from 2018 to 2024.

Applying these inclusion criteria in the filtering for the evaluation of logical expressions, 266 related scientific contributions were obtained. Subsequently, we proceeded to classify into three concepts Sustainability, Green IT, Green Software, and the articles related to each other, as can be seen in Figure 3.

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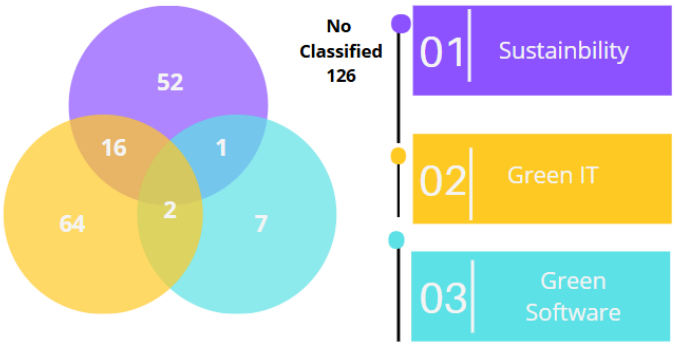

Figure 3. Classification of selected articles

4.3 Classification of Selected Articles

To ensure an organized structure in the research, the selected articles were classified based on the **core themes** of the study. Table 3 presents the number of papers by category.

Table 3. Number of papers by type classification.

Type of classification	Number of papers
Sustainability	52
Green IT	64
Green Software	7
No classified	126
Green IT, Sustainability	16
Green IT, Green Software	2
Sustainability, Green Software	1

4.4 Bibliometric Information

The bibliometric analysis of the selected articles highlights a growing trend in Green IT and Green Software research. The classification by year indicates an increasing interest in sustainability-related technologies.

Since the COVID-19 pandemic, there has been a remarkable increase in research focused on Green IT, Green Software, and Sustainability, as shown in Table 4 and Figure 4. This reflects a shift in global awareness and academic interest in environmental sustainability through technological advancements.

Table 4. Number of articles by year of publication.

Year of publication	Number of items
Less than 2020	16
2020	17
2021	24
2022	18
2023	31

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2024	38

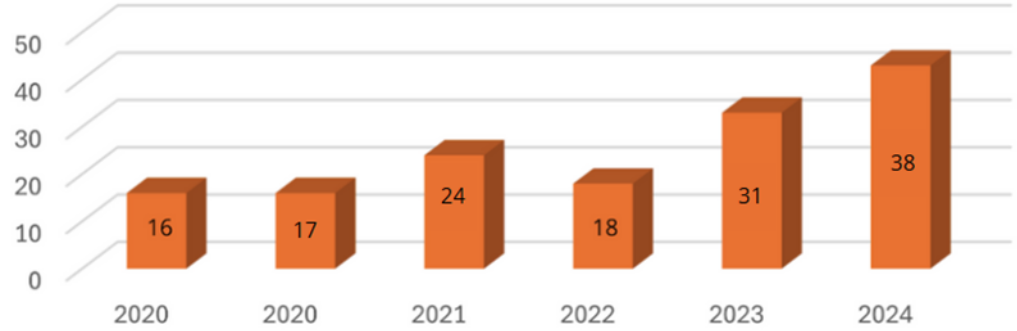

Figure 5. Classification of selected articles.

Table 5. Classification of references by year of publication.

Year of publication	Reference
<2020	[27] [31] [46] [56] [67] [69] [71] [76] [82] [87] [89] [92] [96] [98] [102] [111]
2020	[7] [21] [42] [43] [44] [45] [60] [61] [62] [64] [70] [73] [74] [81] [86] [101]
2021	[9] [11] [14] [15] [25] [28] [32] [33] [39] [41] [47] [48] [50] [53] [68] [75] [80] [85] [91] [95] [106] [108] [109] [110]
2022	[6] [10] [18] [20] [22] [26] [30] [38] [40] [52] [54] [55] [59] [65] [91] [103] [104] [105]
2023	[5] [8] [12] [13] [17] [18] [19] [23] [24] [29] [34] [35] [36] [37] [49] [51] [57] [58] [63] [66] [72] [77] [78] [79] [83] [84] [88] [93] [94] [97] [99] [100] [107]
2024	[113] [114] [115] [116] [117] [118] [119] [120] [121] [122] [123] [124] [125] [126] [127] [128] [129] [130] [131] [132] [133] [134] [135] [136] [137] [138] [139] [140] [141] [142] [143] [144] [145] [146] [147] [148] [149] [150] [151] [152] [153] [154] [155]

Since the pandemic, there has been a remarkable growth in research focused on Green IT, Green Software and sustainability, as shown in Table 5.

5. Classification

This section proposes a classification based on the findings of the systematic literature review (SLR). The purpose of this classification is to structure the existing knowledge on Green IT, Green Software, and Sustainability, making it easier to identify trends, research gaps, and key areas for future exploration.

Table 6 presents an overview of the classification, summarizing the number of reviewed studies under each category. It highlights how the majority of research focuses on Green IT, followed by Sustainability, while Green Software remains a relatively underexplored area.

Table 6. Classification of references by category.

Category	**Reference**

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Sustainability	[5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [118] [121] [124] [126] [127] [128] [129] [132] [133] [140] [142] [147] [151] [154]
Green IT	[42] [43] [44] [45] [46] [47] [48] [49] [50] [51] [52] [53] [54] [55] [56] [57] [58] [59] [60] [61] [62] [63] [64] [65] [66] [67] [68] [69] [70] [71] [72] [73] [74] [75] [76] [77] [78] [79] [80] [81] [82] [83] [84] [85] [86] [87] [88] [120] [122] [125] [126] [130] [131] [133] [134] [135] [138] [139] [145] [146] [149] [150] [153]
Green Software	[89] [90] [91] [92] [93] [117] [129]
Sustainability – Green IT	[94] [95] [96] [97] [98] [99] [100] [101] [102] [103] [104] [105] [106] [107] [108] [123]
Green IT – Green Software	[109] [110]
Sustainability – Green Software	[111]

The classification is divided into three main categories:

- **Sustainability:** Focused on environmentally responsible IT practices, including energy efficiency, emissions reduction, and resource management.
- **Green IT:** Encompasses sustainable hardware and software solutions aimed at reducing the environmental impact of information and communication technologies.
- **Green Software:** Examines how software development and optimization techniques contribute to sustainability by minimizing computational resource consumption.

5.1 Sustainability

Sustainability in IT refers to technological practices that promote responsible resource usage, reduce waste, and minimize environmental impact. Studies in this category focus on energy efficiency, environmental impact, and sustainable innovation.

Energy Efficency

Several studies analyze strategies for reducing energy consumption in IT infrastructures. The authors in [7] provide theoretical frameworks on behavioral changes that improve sustainability in ICT, emphasizing the role of human factors. Similarly, the study in [40] explores machine learning techniques to optimize energy consumption in building management systems, improving indoor air quality and efficiency.

Environmental Impact

Other works highlight the long-term environmental effects of Green IT and Green Software. The authors in [121] examine clean technologies and their potential to reduce CO_2 emissions, manage waste, and transition to a circular economy. Meanwhile, in [124], researchers discuss how emerging technologies, including AI, could have both positive and negative environmental implications, emphasizing the importance of sustainable policies.

Innovations in Sustainable Computing

Recent contributions explore the integration of advanced technologies for sustainability. The study in [118] evaluates AI and IoT applications in precision agriculture, focusing on optimizing resource usage. Additionally, in [126], the

sustainability of cloud computing is analyzed, identifying trends and areas of opportunity in energy-efficient data centers.

5.2 Green IT

Green IT focuses on the responsible use of ICTs to reduce environmental impact, covering both hardware and software solutions. Studies in this category emphasize energy-efficient infrastructure, network optimization, and emerging technologies.

Energy-Efficient Infrastructure

The study in [42] proposes a four-tier architecture for IoT-based sustainable agriculture, classifying potential security and privacy challenges while analyzing blockchain applications for data integrity. Similarly, in [47], researchers investigate optical wireless communication (OWC) as a potential green solution for next-generation networks.

Network Optimization and Power Consumption

Improving the energy efficiency of computing networks is a key focus of Green IT research. The authors in [63] explore methods to reduce power consumption in IoT devices, while the study in [59] discusses the role of artificial intelligence in optimizing power generation from renewable sources.

Applications of Emerging Technologies

Several studies highlight the potential of AI, blockchain, and IoT to improve sustainability in IT systems. The authors in [48] examine blockchain-based smart grids, while the study in [145] discusses Green AI techniques for reducing the carbon footprint of machine learning models.

5.3 Green Software

Green Software focuses on developing environmentally sustainable software solutions by minimizing resource consumption and optimizing algorithms. Due to the limited number of studies in this area, the research is more concentrated on specific use cases.

Optimizing Software for Energy Efficiency

Several studies analyze how software design impacts sustainability. The authors in [92] discuss energy-efficient practices in cloud-based applications, while in [93], the study examines sustainable network architectures for 6G communication systems.

Sustainable Development in Software Engineering

Researchers in [117] review best practices in sustainable software engineering, highlighting methods to reduce the environmental impact throughout the software lifecycle. Similarly, the study in [129] evaluates advances in energy-efficient software development, particularly in data centers and cloud computing environments.

6. Discussion

This section will discuss the results obtained and analyzed from the review carried out in the present work.

The results obtained in the systematic review reflect a growing concern for the environmental impact of technologies and the need to develop sustainable practices. It is observed that the largest volume of research is focused on Green IT, which is understandable given its comprehensive focus on hardware and software to reduce environmental impact. However, the significantly lower number of research in Green Software highlights an important gap, considering that this area can complement Green IT initiatives by optimizing the use of resources at the software development and implementation level. Furthermore, the focus on sustainability suggests that the scientific community is also interested in solutions that transcend the technological realm, integrating social and economic aspects for a positive global impact. The recent trend of incorporating emerging technologies such as artificial intelligence, blockchain and IoT in these fields suggests a focus on innovative solutions to address environmental challenges. These results underscore the importance of fostering collaborative and interdisciplinary research to achieve sustainable technological development.

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The classification into the topics of Sustainability, Green IT and Green Software answers the need to approach the problem of technological sustainability from different perspectives.

Sustainability: This topic is fundamental, as it seeks comprehensive solutions that reduce environmental impact while improving the quality of life for current and future generations. Studies in this category explore the responsible use of natural resources, emissions mitigation and environmental conservation, connecting technology to broader sustainable development goals.

Green IT: The Green IT classification is relevant because of its focus on the responsible use of ICTs, from energy optimization in data centers to the implementation of sustainable infrastructures. This area analyzes how existing technologies can be modified to mitigate environmental impact.

Green Software: This topic, although less developed, is crucial because it focuses on the creation and use of software that reduces the consumption of computational and energy resources. The optimization of algorithms and processes in the software life cycle has the potential to complement Green IT initiatives, improving the overall efficiency of technological systems.

Taking into account the proximity of the works investigated, it is remarkable to observe how the problem of preserving the environment and the concern of the effects caused by the use and improper development of technological tools, has been considered since even years before 2020, however, this topic received its peak of concern and research in 2024, where the largest number of articles on the subject have been found. This fact may be due to the recent rise of artificial intelligences and the use of cryptographic tools such as cryptocurrencies and blockchain technology.

In addition, it can be seen from the research that most of the researchers have chosen to focus their studies on Green IT technologies. This may be due to the fact that Green IT technologies refer to a broader and more general approach to the use of both hardware and software tools to reduce the impact on the environment, by not focusing on a single type of technology, they manage to complement the studies of the fields of IoT and Software in a single set to give a recommendation when creating this type of technologies. However, there is also a high rate of research that is focused on sustainability, these focus on finding ways to improve the current living conditions without further harming to the environment to provide better opportunities and quality life for future generations.

Similarly, considering all the works carried out, it can be seen how smart cities, IoT devices and cryptography focused environments are the ones that present the greatest topic of discussion.

It is important to highlight some limitations of the study, within the use of databases such as Google Scholar, IEEE Xplore and Science Direct may have limited the scope, as relevant studies outside these platforms were not considered. In addition, specific keywords such as “Green IT” and “Green Software” may have excluded research with different terminology, affecting the diversity of the reviewed studies.

As for the gaps identified, there is a lack of standardized methodologies to evaluate the maturity of the adoption of green software practices in different industries. In addition, although emerging technologies such as artificial intelligence and blockchain are mentioned as promising, their application in the field of Green IT has not yet been exhaustively explored. Finally, the implementation of green technologies in developing regions faces challenges related to infrastructure and policies that require further attention.

7. Conclusions

In this article, it has been possible to summarize the most recent research works on sustainability focused on the use of green technologies Green IT and Green Software. It was tried to show how this issue is a topic of current interest and should be addressed as soon as possible to reduce the impact of technology use today. In addition, previous works have been reviewed to find fields in which these green technologies may not have been applied.

Knowing the concepts of Green IT and Green Software focused on environmental sustainability. The use of emerging technologies such as blockchain, 5G, 6G, Big Data Streaming, among others, has been studied. In addition to seeking to implement a technique to be able to suppress the impact generated by them, we try to understand how it could affect the sustainability of the planet and if it is possible to implement them for the future technologies not yet created.

This article can contribute to future research to create new knowledge on the impact of environment and the sustainability of green technologies.

Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Figure S1: title; Table S1: title; Video S1: title.

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