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IMPACTS OF GREEN COMPUTING

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# ABSTRACT

*Green computing is an area of study and development that is growing quickly. Its goal is to make IT systems less harmful to the environment. The goals of green computing are to use less energy, save resources, make computers more efficient, and help the environment. The effects of these goals are wide-ranging and help both the environment and the economy. By using green computing practices, businesses can lower their operational costs, boost their image, follow environmental laws, and help make the future more sustainable. The main goal of this seminar is to provide an overview of Green Cloud Computing and how computers and their accessories can be used in an efficient and cost-effective way to cut down on pollution.*

*By looking at what they can't do, we can figure out why companies, experts, and end users haven't fully adopted green computing.This seminar paper will look at how green computing goals affect organizations and society as a whole, and it will also give suggestions for how different industries can start using green computing practices.This paper will indeed help other researchers learn more about Green computing in the near future.This seminar paper is worth pursuing because it is easy for other researchers to get information from it and learn about Green Computing Technology.This paper will explain how to use Green Computing in a way that helps the environment as little as possible.Overall, it's important to understand what Green technology is and how it tends to help the environment use less energy.*

CHAPTER 01

# 1.0 INTRODUCTION

Green computing refers to the environmentally responsible, sustainable, and eco-friendly utilization of computing technology/peripherals and its associated resources. It also includes other aspects, such as the study of building, developing, producing, utilizing, and disposing of computer hardware in a manner that is kind to the environment.

The use of computer technology (IT) has developed at an exponential rate over the past few years, which has led to an increase in the amount of energy consumed as well as the impact on the environment. As a direct result of this, there has been an increase in interest of people in green computing, that refers to the creation and implementation of ecologically responsible and favorable IT infrastructure (Jain, 2018).

Because of the urgent need to reduce the negative effects that information and technology (IT) systems have on the surrounding environment, "green computing" has emerged as an essential field for study and development in recent years. The term "green computing" refers to the process of designing, developing, and putting into action information technology (IT) systems that are environmentally responsible, efficient with energy use, and kind to available resources. There are many different goals that can be accomplished by green computing. Some of these goals include promoting sustainability, decreasing energy usage, conserving resources, and increasing efficiency. These goals have wide-ranging effects, and they will be beneficial to the environment as well as the economy if they are achieved. In this seminar essay, we will investigate the effects that the goals of environmentally friendly computing have had on both organisations and society. We will conduct a literature study/review on the relevant topics and suggest recommendations for the implementation of environmentally friendly computing techniques across a variety of organizations.

According to the findings of a study conducted by Bhardwaj et al. (2020), that adoption of environmentally friendly computing procedures has the potential to not only lessen the impact that a business has on the environment, but also to improve its financial standing. According to the findings of the study, businesses are able to realize significant cost savings and cut their carbon emissions by using techniques for power management, optimizing system settings, and adopting energy-efficient hardware. In a different piece of research, Khare and Sahu et al. (2018) highlighted the significance of digital record keeping and recycling of electronic waste as essential components of green building practices that can assist in the conservation of resources and the reduction of waste.

In this seminar paper, we will discuss the impacts that green computing goals have on enterprises as well as society by reviewing these studies as well as additional relevant research. We are going to look into the advantages of green computing, including how it may save money, help preserve resources, improve organisation's reputations, and reduce energy consumption. In addition, we will tackle the difficulties associated with the implementation of environmentally friendly computing practices.

# 1.2 OBJECTIVES

1. Reduce the amount of energy that is used. Green computing has as one of its key goals the reduction of the amount of energy that is used. Organizations are able to cut their energy consumption, which leads to cheaper expenses and less carbon emissions. This can be accomplished by installing hardware that is more energy-efficient and by optimizing system settings.
2. The goal of green computing is also to save resources by reducing waste as much as possible and making the most efficient use possible of available resources. Recycling of electronic garbage, administration of digital records management, and operation of data centers that are energy-efficient are examples of these techniques.
3. Improved efficiency is attainable with the use of green computing techniques thanks to the optimization of system performance and the reduction of downtime. Organizations are able to reduce their overall energy waste and increase the overall efficiency of their systems by employing various power management approaches.
4. Green computing's primary objective is to promote longevity by reducing its negative impact on the environment and increasing its emphasis on environmentally responsible behavior. Businesses have the opportunity to lessen their impact on the environment and help contribute to a cleaner future by adopting environmentally friendly computing practices.
5. To gain an understanding of why "green computing" hasn't been fully implemented across a variety of businesses, among varied experts, and among end customers, by examining the limits of these entities.

The main reason we should consider using Green computing technology is that it has environmental benefits Green computing methods can have a large positive influence on the environment by lowering energy usage and preserving resources. This helps to reduce carbon emissions and contributes to sustainability.

# 1.3 JUSTIFICATION

The implications of environmentally responsible computing will play an essential role in the research conducted in the future and will be of interest to a wide range of audiences. This research can provide information into the issues that must be overcome in order to promote a wider acceptance of environmentally friendly computing practices by examining the advantages and drawbacks of green computing techniques. This research paper can serve as a foundation for additional research on the subject, which will assist to develop the area of study and promote the adoption of environmentally friendly computing methods on a more general scale.

Also, the implications of environmentally friendly computing techniques have important effects on those who make decisions, like business owners and politicians. This work has the potential to influence decision-makers and support the implementation of sustainable computational practices by drawing attention to the benefits of environmentally friendly computing, such as decreased energy usage, cost savings, and increased environmental sustainability.

In addition, this work has the potential to act as a source of knowledge and education for the public at large, thereby increasing awareness of the significance of environmentally responsible computing practices as well as the part that people and organizations could perhaps play in lessening their impact on the environment. This work has the potential to contribute towards a more stable future for everyone by emphasizing the importance of adopting a computing methodology that is less harmful to the environment and more sustainable.Eco friendly computing methods have the potential to lower energy consumption, prices, and improve environmental sustainability (Kaur & Kumar et al. 2014).

# 1.4 METHODOLOGY

This study is a project that uses secondary research to look into the effects of green computing. After reading a lot about "green computing," "energy efficiency," and "environmental sustainability," we came up with the goals and reasons for this research.

For this study, records, journals, reports, and websites, as well as academic databases like the World Wide Web of Science, and Google, were used as sources of information. The keywords "sustainable computing," "green computing," "environmental impact," "efficient energy," and "business social responsibility," were used as part of the search strategy to find relevant sources. The criteria for including source materials were based on how well they fit with the study's goals and justifications.

Concerns about ethics were taken into account by making sure that all materials were cited correctly and that private data was not shared. One problem with this study is that it is based on the secondary sources, which might also make the results less reliable. But the study's results are more likely to be accurate because they come from more than one source and were collected and analyzed in a structured way.

In summary, this study used a secondary research method called a thorough review and interpretation of the available relevant literature on green computing technology. The sources of data used in this research were carefully chosen based on how well they fit with the study's goals and justifications. The data were then analyzed by concept to find the most important effects of green computing.

CHAPTER 02

# 2.1 LITERATURE REVIEW

## 2.1.2 HISTORY OF CLOUD COMPUTING

Green computing, also called "green IT," grew out of people's growing worries about how computers affect the environment. Green computing has been around since the 1990s, when research teams started looking for ways to make computer systems and data centers use less energy (Murugesan et al., 2008). In 2001, the Environmental Protection Agency (EPA) was the first to use the term "green computing" to describe efforts to make computers use less energy and be better for the environment.

Since then, the idea of "green computing" has grown into a key focus for research groups, businesses, and governments all over the world. With the growth of fresh technologies like cloud computing and virtualization, there are now more ways to reduce energy use and make computing more sustainable.

Green computing is also a big deal for policymakers, who see that technology has the potential to help solve environmental problems. For example, the European Union has set goals for reducing energy use in data centers, and the US government has set up the Federal Energy Management Program to encourage energy efficiency in federal buildings, including data centers.

## 2.1.3 FURTHER EXPLANATION TO OBJECTIVES

1. **Reduce the amount of energy that is used.**

Green computing is an idea that tries to reduce the damage that computers do to the environment by making sure that they use as little energy as possible. This is done by using different strategies, such as hardware that uses less energy, software as a service, power saving, and cloud services. These strategies help devices, data centers, and servers use less energy, which in turn has a smaller impact on the environment. Green computing has been used in places like data warehouses, personal computing, and transportation. By using green computing procedures, it is achievable to cut down on energy use and lessen the damage that computers do to the environment.

1. **The goal of green computing is also to save resources by reducing waste.**

Green computing is a way to use less energy and less waste. This is done by extending the life of electronic equipment and getting rid of the elimination hazardous materials as little as possible. This can be done by recycling, fixing up, and disposing of electronic waste in a responsible way, among other things. Green Technology also encourages the creation of goods and their packaging that are good for the environment and can be broken down and reused easily. Green computing practices are particularly important in industries like electronics manufacturing, where a lot of waste is made and needs to be cut down. For instance, firms such as Dell have set up a closed-loop recycling program in which they take materials from products that have reached the end of their useful life and recycle them in order to make new products. This reduces waste and helps the environment.

1. **Improved efficiency is attainable with the use of green computing techniques thanks to the optimization of system performance and the reduction of downtime.**

Using green computing methods may improve system performance and cut down on downtime, making the system more efficient overall. By using hardware that uses less energy and power management techniques, electronic devices can work at their best, which means they can do their jobs faster and have less downtime. Virtualization and cloud services can also help improve system efficiency by decreasing the necessity of physical hardware and making better use of available resources. Green computing has been used to enhance the effectiveness of computer systems in many fields, such as finance, health care, and education. For instance, a health center in the UK used a green computing approach that cut energy use by 30%. This saved the hospital a lot of money and made the system run better.

1. **Green computing's primary objective is to promote longevity by reducing its negative impact on the environment and increasing its emphasis on environmentally responsible behavior.**

This is achieved by use :-

1. software and devices that use less energy: Green computing tends to encourage the use of software and hardware for computers that use less power, make less heat, and give off fewer emissions.
2. Renewable sources of energy: Another way to use green computing to promote longivety is to power computers and data centers with renewable energy sources like solar, wind, or water power. This can help cut down on the use of fossil fuels and reduce the amount of carbon that computing operations use up.
3. Electronic waste-waste management: Green IT also encourages recycling and proper disposal of (e-waste). This means using the right ways to get rid of electronic waste that are good for the environment and people's health, as well as fixing up and reusing older equipment.

In real life, a good example of green computing has been the Google data center in Hamina, Finland, that also gets all of its power from wind, water, and solar power. The data center uses new cooling methods like saltwater cooling as well as free cooling, which cut the amount of energy it uses by up to 50%. Google also has set up a full scheme to cope with ewaste, which involves recycling old equipment as well as getting rid of toxic materials in the right way.

## 2.1.4 BENEFITS OF IMPLEMENTING GREEN COMPUTING PRACTICES

1. Reduced energy use and cost: Green computing encourages energy-efficient software as well as hardware, that can lower businesses' energy use and expenditures.
2. Reduced emissions of greenhouse gases and lower carbon footprint: Using renewable energy resources and energy-saving techniques can help reduce the greenhouse gas emissions and reduce the carbon footprint of computing processes.
3. Increasing use of sources of renewable energy: Green computing can promote the use of energy from renewable sources to power computer systems and data centers, including wind, sunlight(solar), and hydro power.
4. Increased equipment lifespan and decreased e-waste: Effective electronic waste management and recycling can increase equipment lifespan and decrease e-waste production.
5. Green IT can assist in reducing the negative effects of computers on the environment while encouraging more environmentally friendly behaviors.
6. Increased corporate/organization social responsibility and reputation: Putting green computing methods into practice can enhance an organization's reputation and corporate social responsibility.
7. Improved morale and engagement of staff: Working for a company that encourages environmentally responsible behavior may increase staff engagement and motivation.
8. Reduction in risk of penalties and fines: Organizations can reduce their risk of penalties and fines by complying with environmental standards.

## 2.1.5 DRAWBACKS OF IMPLEMENTING GREEN COMPUTING PRACTICES

High costs at the start: Using green computing methods and equipment may cost a lot at first, which could be a problem for some organizations.

Renewable sources of energy may not be easy to find or might be too expensive to use in some areas.

Performance impact: Some green innovation practices, such as using less energy or using hardware that uses less energy, may damage the performance of a computer.

Some green technological solutions may not be able to be used on a large scale or may need large infrastructure changes to be used effectively.

Complexity: Using and having to manage green computing methods and tools(technologies) may require specialized abilities and assets, which could make IT operations more difficult and expensive to run.

## 2.1.6 WHY GREEN COMPUTING HAS NOT BEEN ADOPTED FULLY IN VARIOUS ORGANIZATION AND INVIDUALS

Adopting green computing techniques can be difficult for businesses and individuals for a number of reasons. The high upfront expenditures of integrating green computing technologies and practices are one of the main hurdles. Energy-efficient hardware, renewable energy, and other green technology can be excessively expensive for many companies to invest in, especially small and medium-sized firms that may have limited funding.

The lack of knowledge and comprehension of the advantages of green computing is another problem. It's possible that many businesses and people are unaware of the potential financial savings, environmental advantages, as well as other advantages of using green IT techniques. Green computing may also be seen by some as a needless investment or a low concern in comparison to other professional or private requirements.

Another difficulty in setting up and overseeing green computing techniques is their complexity. Green computing frequently entails making considerable adjustments to IT operations and infrastructure, which can call for specific knowledge and resources. For firms without the skills and resources needed to successfully implement green IT practices, this complexity can be a hindrance.

## 2.1.7 GREEN COMPUTING IN KENYA

Green computing has indeed been adopted in different industries in Kenya, with major environmental and societal implications. Green computing has had the following effects in Kenya:

Energy Efficiency: To reduce energy usage and carbon impact, green computing technologies like as virtualization, cloud services, and energy-efficient equipment have been adopted in Kenyan data centers as well as other computing facilities.Data centers such as Safaricom Data Center - Owned by Safaricom, it is located in Nairobi and provides cloud and data storage services and Telkom Kenya Data Center - Located in Nairobi, it provides co-location, cloud, and disaster recovery services. This has resulted in cost savings for companies as well as a reduction in greenhouse gas emissions.

Waste Decrease: E-waste is a major environmental threat in Kenya. To minimize e-waste and promote sustainability, green computing methods such as recycling and refurbishment of old and abandoned computer systems have been implemented.

Rural Connectivity: To enhance the availability of communication and information technology, green computing techniques such as energy from the sun workstations and low-power server have been adopted in Kenya's rural areas.

Green computing techniques like precision agriculture and intelligent irrigation systems have been adopted in Kenya to improve sustainable agriculture practices while also reducing water and energy usage.

The Kenyan government, as well as the educational system, the medical system, and the agricultural industry, have all started using environmentally friendly computer practices. The Kenyan government, for example, has launched an initiative to digitally manipulate its records and install energy-efficient computing equipment in government offices. Green computing technologies have also been introduced by the Kenya Education Network (KENET) at colleges and universities in order to minimize energy usage and improve sustainability. Green IT has been adopted in the health sector to increase the availability of medical services and decrease health care waste.

Overall, green computing has had a substantial impact on both the environment and community in Kenya, and it is projected to continue to expand as more enterprises support sustainable methods and technologies.

CHAPTER 03

# CONCLUSION AND DISCUSSION

Green computing has evolved as an important area in recent years as the IT sector has begun to acknowledge the huge environmental impact it has. This research article demonstrated that green computing techniques can assist firms in reducing their energy use, saving money, and lowering their carbon footprint. However, there are certain drawbacks to integrating green computing technology, such as high upfront costs, implementation complexity, and security trade-offs. Besides these limitations, enterprises must emphasize green computing because it has the capacity to provide considerable long-term advantages.

Going ahead, there are various new developments within green IT that should be considered. They include using machine learning and AI to improve energy usage, developing more energy-efficient gear, and boosting the use of energy from renewable sources such as sunlight and wind power. Furthermore, the rise of cloud computing as well as virtualization is expected to continue, opening up new opportunities for businesses to cut their energy use and carbon impact. Nevertheless, the potential of green computing appears promising, and firms who engage in this technologies are expected to gain long-term benefits.

To summarize, green computing is indeed a vital tool with the potential to greatly minimize the IT industry's environmental effect. Although there are challenges to integrating green computing methods and technologies, the advantages are obvious. As a result, it is critical that businesses and individuals emphasize green computing, expand in innovative technology, and try to reduce their energy use and carbon impact. Green computing does have the potential to change the IT sector and build a more environmentally friendly future with sustained innovation and investment.

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