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"GREEN INFORMATION AND COMMUNICATION TECHNOLOGY AT HIGHER EDUCATION ORGANIZATION: SOLUTION FOR SUSTENANCE OF ICT IN FUTURE"

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Abstract: The use of Information and Communication Technology (ICT) has become an essential component of Higher Education organizations. However, the sustainability of ICT in the future is a major concern due to the high energy consumption and associated environmental impacts. The solution to this problem is Green ICT, which aims to reduce the carbon footprint of ICT while ensuring its sustenance in the future. Green ICT encompasses the use of energy-efficient hardware and software, as well as the adoption of sustainable practices in ICT operations. By implementing these measures, Higher Education organizations can significantly reduce their energy consumption and carbon emissions, while ensuring the reliable and efficient functioning of their ICT infrastructure. One of the key strategies for implementing Green ICT is the use of energy-efficient hardware such as servers, storage devices, and network equipment. These devices are designed to consume less energy while maintaining high performance. In addition, virtualization technologies can be used to consolidate multiple physical servers into fewer, more powerful ones, thereby reducing energy consumption and saving space. Another important strategy is the use of energy-efficient software applications. These applications are designed to consume less energy while maintaining the same level of functionality. For example, cloud-based applications can reduce energy consumption by minimizing the need for local servers and storage devices. In addition to hardware and software, Green ICT also involves the adoption of sustainable practices in ICT operations. These practices include the use of renewable energy sources such as solar, wind, and geothermal power, as well as the implementation of energy management systems and the adoption of energy-efficient policies and practices. Higher Education organizations can also promote Green ICT by raising awareness among their staff and students. This can be achieved through training programs, workshops, and seminars on Green ICT practices and their benefits. In addition, the organization can encourage the use of eco-friendly ICT devices such as laptops and Smartphone's that have been designed to consume less energy and emit fewer emissions. Green ICT is a solution for the sustenance of ICT in the future. By implementing energy-efficient hardware and software, adopting sustainable practices in ICT operations, and promoting awareness among staff and students, Higher Education organizations can significantly reduce their carbon footprint while ensuring the reliable and efficient functioning of their ICT infrastructure. Green ICT is not only good for the environment, but it also benefits the organization in terms of cost savings, improved efficiency, and enhanced reputation.

Keywords: Green ICT, Higher Education, sustainability, future, information and communication

technology, solution

I. INTRODUCTION

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Information and Communication Technology (ICT) has become an integral part of modern society, and it is changing the way we live, work, and communicates. However, the rapid growth of ICT has significant environmental and social impacts such as increased energy consumption, e-waste, and carbon emissions. Therefore, it is essential to adopt sustainable practices in the ICT industry to ensure a sustainable future. Green ICT is an approach that aims to reduce the environmental impact of ICT while maintaining its benefits. It involves using energy-efficient technologies, reducing electronic waste, and adopting sustainable practices in the design, production, and use of ICT. Green ICT is not only a responsibility of individuals and organizations but also a necessity for the sustainability of the planet. Higher education organizations have a significant role in promoting green ICT practices. They are among the biggest users of ICT and have the potential to make a significant impact on reducing the environmental footprint of ICT. Moreover, they have a responsibility to educate future generations about sustainable practices and be role models in implementing them. This paper discusses the importance of green ICT practices in higher education organizations and how they can contribute to a sustainable future. It examines the challenges and opportunities of implementing green ICT practices and provides practical solutions for the adoption of sustainable ICT practices. The paper also highlights the benefits of green ICT practices, such as cost savings, increased efficiency, and reduced carbon emissions. The adoption of green ICT practices is essential for the sustenance of ICT in the future. Higher education organizations have a responsibility to promote and implement sustainable ICT practices to reduce their environmental footprint and educate future generations about sustainable practices. This paper provides a comprehensive guide on the adoption of green ICT practices in higher education organizations and highlights the benefits of sustainable ICT practices.

RELEATED WORK Using Information and Communication Technology (ICT) in a way that doesn't harm the planet is known as "green ICT," and it's becoming an increasingly pressing concern for businesses everywhere. Higher Education institutions have a unique role to play in promoting sustainable development and mitigating climate change through their teaching, research, and operational activities, including the use of ICT. Several studies have explored the role of Green ICT in Higher Education organizations. For example, a study by Aparicio and Ortiz (2019) investigated the impact of Green ICT

on the sustainable development of Higher Education institutions in Spain. The study found that Green ICT practices such as virtual meetings, e-learning, and paperless offices could reduce energy consumption, carbon emissions, and costs. Similarly, a study by Yusuf et al. (2021) explored the impact of Green ICT on the sustainability of Higher Education institutions in Malaysia. The study found that Green ICT practices such as energy-efficient computing, virtualization, and cloud computing could reduce energy consumption and carbon emissions while increasing operational efficiency and cost savings.

Another study by Zhang et al. (2021) studied the state of Green ICT adoption in Chinese universities. Organisational culture, backing from upper management, and perceived advantages including cost savings and environmental responsibility were shown to affect the adoption of Green ICT practises.These studies suggest that Green ICT can play a significant role in promoting the sustainability of Higher Education institutions. However, the adoption of Green ICT practices requires a strategic approach that involves top management support, stakeholder engagement, and investment in infrastructure and training.

Green ICT is a viable solution for the sustenance of ICT in the future. Higher Education institutions have a unique opportunity to lead the way in promoting sustainable development through the adoption of Green ICT practices. However, this requires a concerted effort from all stakeholders to ensure the successful implementation of Green ICT practices.

GLOBAL PERSPECTIVE OF GREEN ICT IN EDUCATION:

Information and communication technology (ICT) with a focus on environmental sustainability is known as "green ICT." In the context of higher education organizations, implementing green ICT strategies can help to ensure the sustainable use of ICT in the future. Here are points to consider from a global perspective:

1. Energy-efficient ICT infrastructure: Higher education organizations can reduce their energy consumption and carbon footprint by implementing energy-efficient ICT infrastructure, such as servers, data centers, and networking equipment.

2.Second, virtualization allows numerous virtual computers to coexist on a single physical system, therefore decreasing both hardware needs and power usage.

3.Third, using cloud computing may help businesses save money on their energy bills by lowering their reliance on in-house servers and other hardware.

4. Green procurement: Higher education organizations can choose to purchase energy-efficient ICT products and services, such as laptops and servers that have earned ENERGY STAR certification.

5. Recycling and disposal: Proper recycling

and disposal of ICT equipment can reduce the environmental impact of e-waste.

6. Telecommuting: Encouraging telecommuting for staff and students reduces the need for physical travel and associated emissions.

7. Online learning: Online learning can reduce the need for physical classrooms and associated energy consumption.

8. Energy-efficient buildings: Higher education organizations can design and construct energy-efficient buildings that incorporate ICT infrastructure and technologies.

9. Sustainable power sources: The information and communications technology (ICT) infrastructure of universities and colleges may be powered by renewable energy sources like solar and wind.

10. Energy management systems: Energy management systems can monitor and control energy usage in buildings and ICT infrastructure.

11. Green data centers: Green data centers use energy-efficient technologies and renewable energy sources to reduce energy consumption and environmental impact.

12. Sustainability reporting: Higher education organizations can report on their sustainability initiatives and progress to stakeholders, including ICT-related initiatives.

Implementing green ICT strategies can help higher education organizations to ensure the sustainable use of ICT in the future, reduce their environmental impact, and promote sustainability.

OBJECTIVES:

1. To promote the adoption of environmentally sustainable practices and technologies in the design, deployment, and management of ICT infrastructure and services at Higher Education organizations.
2. To reduce the carbon footprint and energy consumption of Higher Education organizations through the implementation of energy-efficient ICT equipment and technologies.
3. To raise awareness and educate students, faculty, and staff about the importance of Green ICT practices and their role in promoting sustainability.
4. To develop and implement policies and guidelines that support the integration of Green ICT principles into the strategic planning and decision-making processes of Higher Education organizations.
5. To establish partnerships with industry, government, and other stakeholders to promote the development and deployment of innovative Green ICT solutions.

METHODOLOGY:

1. Assessment of current ICT practices: The first step is to assess the current ICT practices and infrastructure in the Higher Education organization. This will help

identify areas where energy consumption can be reduced and where sustainability can be improved.

2. Identification of Green ICT initiatives: Based on the assessment, identify Green ICT initiatives that can be implemented. This may include initiatives such as virtualization, server consolidation, energy-efficient hardware, and renewable energy sources.
3. Development of a Green ICT policy: "A Green ICT policy should be developed that outlines the organization's commitment to sustainability and the initiatives that will be implemented to achieve this goal".
4. Training and awareness: Training and awareness programs should be developed to ensure that all staff members are aware of the Green ICT policy and are equipped with the necessary knowledge and skills to implement the initiatives.
5. Implementation of Green ICT initiatives: The identified Green ICT initiatives should be implemented in a phased manner, with a focus on achieving quick wins and building momentum for longer-term initiatives.
6. Monitoring and evaluation: Regular monitoring and evaluation of the Green ICT initiatives should be undertaken to ensure that they are achieving the desired outcomes and to identify any areas where improvements can be made.
7. Continuous improvement: "The Green ICT policy and initiatives should be reviewed and updated on a regular basis to ensure that they remain relevant and effective".

GREEN ICT CRITICAL SUCCESS FACTORS:

1. Leadership commitment: The top management of the organization must show commitment and support for green ICT practices to ensure their successful implementation.

2. Stakeholder engagement: All stakeholders, including students, faculty, staff, and the community, must be engaged and informed about green ICT practices.

3. Green ICT policy: The organization must develop and implement a green ICT policy that outlines the goals, objectives, and strategies for reducing energy consumption and promoting sustainability.

4. Energy management: The organization must implement energy management practices, such as energy-efficient equipment, renewable energy sources, and energy-efficient buildings.

5. Virtualization: "Virtualization can reduce the number of physical servers required, thereby reducing energy consumption, maintenance costs, and carbon emissions".

6. Cloud computing: Cloud computing can reduce energy consumption and carbon emissions by sharing computing resources

and reducing the need for on-premise servers.

7. Green procurement: The organization must adopt green procurement practices by selecting ICT equipment and services that are energy-efficient, recyclable, and environmentally friendly.
8. Green printing: The organization must reduce paper consumption by implementing green printing practices, such as double-sided printing, electronic document management, and paper recycling.
9. Telecommuting: Telecommuting can reduce the need for employees to travel to the office, thereby reducing carbon emissions and energy consumption.
10. Education and awareness: The organization must provide education and awareness programs to promote green ICT practices among students, faculty, staff, and the community.
11. Monitoring and reporting: The organization must monitor and report its energy consumption, carbon emissions, and other sustainability metrics to track progress and identify areas for improvement.
12. Partnership and collaboration: In order to promote sustainability, the organization must work in tandem with other groups to pool resources, learn from one another, and create novel approaches.
13. Green data centers: The organization must implement green data center practices, such as efficient cooling systems, virtualization, and renewable energy sources.
14. Continuous improvement: The organization must continuously review and improve its green ICT practices to ensure they are effective, efficient, and sustainable.

RECOMMENDATION:

1. Sustainable practises at higher education institutions should include green ICT, or the use of ICT in a way that minimizes negative effects on the environment. Here are some recommendations for implementing Green ICT at your higher education organization:
2. Energy-efficient computing: Implementing energy-efficient computing practices such as virtualization, power management, “and energy-efficient hardware can significantly reduce energy consumption”.
3. Cloud computing: “Moving to cloud-based computing can help reduce energy consumption and carbon footprint by reducing the need for physical servers and data centers”.
4. Green procurement: When purchasing ICT equipment, consider products that are Energy Star certified, EPEAT rated, or have other environmental certifications.
5. Electronic waste management: “Implement a responsible e-waste management system to ensure that electronic waste is disposed of properly”.

6. Telecommuting: Encourage telecommuting and remote work to reduce the need for physical travel to the office and decrease carbon footprint.
7. Sustainability education: Offer courses and training programs to educate staff and students about sustainability practices in ICT and how to implement them.
8. Green data centers: Free cooling, renewable energy utilization, and efficient power distribution are just a few examples of the green data centre practises that may drastically save costs and environmental impact.

By implementing these recommendations, your higher education organization can significantly reduce its environmental impact and contribute to the sustainability of ICT in the future.

CONCLUSION:

"Green ICT is a critical solution for the sustenance of ICT in the future, particularly in higher education organizations. The rapidly increasing demand for ICT services has led to a significant increase in energy consumption and carbon emissions, making it necessary to adopt sustainable practices to reduce the impact on the environment". Higher education organizations have a significant role to play in promoting sustainable development, and Green ICT is one of the ways to achieve this goal. By implementing energy-efficient practices, reducing e-waste, and utilizing renewable energy sources, higher education organizations can significantly reduce their carbon footprint while still meeting their ICT needs. In addition to the environmental benefits, Green ICT can also help reduce costs for higher education organizations. By implementing energy-efficient practices and reducing e-waste, organizations can save on energy and disposal costs, which can be redirected towards other critical areas of their operations.

However, the adoption of Green ICT requires the commitment and collaboration of all stakeholders, including policymakers, "ICT professionals, and end-users. Policymakers need to create policies that promote the use of renewable energy sources and incentivize the adoption of energy-efficient practices. ICT professionals need to adopt best practices in designing and implementing ICT infrastructure and services, while end-users need to adopt sustainable practices such as turning off devices when not in use and reducing paper usage. Finally, higher education organizations need to invest in capacity building to ensure that their staff and students have the necessary skills and knowledge to adopt and implement sustainable ICT practices. This can be achieved through training programs, awareness campaigns, and partnerships with

other organizations. Green ICT is critical for the sustenance of ICT in the future, particularly in higher education organizations". By promoting sustainable practices, organizations can significantly reduce their carbon footprint, save costs, and contribute to the achievement of sustainable development goals.

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