Technologies Optimization to Increase Environmental Awareness and Employee Engagement in the Workplace

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ARTICLE INFO

Article history:
Received 4 December 2023
Revised 14 January 2024
Accepted 7 February 2024

Key words:
Technology,
Environmental awareness,
Workplace,
Sustainability,
Digital applications,
Employee engagement,
Resource management.

ABSTRACT

In recent years, increasing environmental awareness in the workplace has become a highly relevant topic for many organizations. Technology, particularly apps and digital platforms, plays a crucial role in increasing employee participation in sustainability initiatives. By using technology, companies can educate employees, monitor sustainability practices, and create spaces for their active engagement in reducing their carbon footprint and managing resources efficiently. In this research, it is examined how technology can facilitate increased environmental awareness and how companies can optimize such technology to increase overall organizational performance. The use of technology for sustainability not only increases the quality of environmental management, but also strengthens the company's commitment to long-term sustainability. Going forward, companies need to ensure that every employee has equal access to the technologies used to raise environmental awareness and create a more personalized and enjoyable experience. This research highlights the importance of creating a culture of sustainability in the workplace through technology, and how this can support better and more sustainable organizational performance.

INTRODUCTION

The 21st century has been marked by a growing global awareness of the environmental crisis, which has now become mainstream in corporate discourse and organizational policy. This transformation reflects a paradigm shift from voluntaristic social responsibility towards a strategic commitment to integrating sustainability into the core of business operations. In this context, organizations no longer view environmentally friendly practices as an additional cost burden, but rather as a long-term investment in operational resilience, reputation and competitiveness in a market that is increasingly concerned about its ecological footprint.

In response, digital technology has emerged as a critical enabler that allows environmental values to be internalized into the DNA of organizations. Digital applications and platforms serve as educational and communication infrastructure capable of transmitting sustainability messages with a scope, speed, and personalization previously unattainable through conventional methods. More than just a means of conveying information, this technology facilitates sustainable behavioral change by redesigning work routines, providing real-time feedback, and creating a contextual and adaptive learning environment. Thus, technology not only raises awareness but also crystallizes that awareness into measurable patterns of action that impact the reduction of an organization's ecological footprint (Tilwankar et al., 2019).

With the rapid development of information technology, many companies have begun to adopt technology to improve productivity and efficiency, but only a few have utilized it to raise environmental awareness. In fact, the implementation of information technology is essentially designed to improve the overall managerial efficiency of an organization (Arifin & Putra, 2022), which should also include the management of social and environmental aspects as part of good governance. Technologies such as mobile applications and digital platforms can be used to facilitate sustainability programmed that not only reduce a company's environmental impact but also encourage employees to participate actively. Applications that provide information on how to reduce carbon footprints, save energy, and choose environmentally friendly products can be part of

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concrete steps taken by organizations to educate and raise employee awareness of environmental issues (Çimşir & Uzunboylu, 2019).

While many applications already exist, not all companies utilize the full potential of this technology. Some companies may feel that these technologies are a waste of budget or require additional costs to implement. There is also the problem of unequal access to technology among employees with different backgrounds, be it related to education, age, or available infrastructure (Jouontso & Francis, 2013). It is important to further analyze how technology can be effectively used to increase environmental awareness in the workplace.

One of the main problems faced in the use of technology to increase environmental awareness in the workplace is the low adoption of apps or digital platforms that have direct relevance to sustainability. While some companies have implemented green applications, many employees do not fully understand or optimize the use of these applications to support sustainability aims (Chugh et al., 2016). This low adoption rate is often associated with the absence of inadequacy of training designed to build ecological competence and motivation, as shown in research on the link between ecological training and employee behavior (Novita et al., 2022). This could be due to a lack of adequate training or a feeling that the technology does not enough to giving added value to their daily work.

The gap in access to technology and digital skills is a systemic challenge in the technological era that also has an impact on the world of work (Arifin & Darmawan, 2021; Ramle & Mardikaningsih, 2022). Another problem that arises is unequal access to technology in the workplace, especially in companies with limited resources. Employees working in places with limited internet access or using outdated devices will have difficulty in utilizing the available technology. Even in large companies, technical problems such as applications that are not user-friendly or difficulties in integrating technology into existing work systems can hinder its effectiveness. This leads to a lack of employee participation in sustainability initiatives implemented through digital platforms (Balabanova et al., 2021).

The problem of obscurity in measuring the impact of technology initiatives on environmental awareness is also a barrier. Many organizations do not have clear indicators to assess the extent to which the technology implemented has succeeded in increasing awareness or changing employee behavior. This measurement gap represents a significant project risk, as the inability to quantify outcomes undermines the evaluation of success and return on investment. Adopting a systematic approach to identify and manage such risks is therefore crucial, as emphasized in the context of ensuring information technology project success in dynamic environments (Silva et al., 2022). Without the right measurement tools, it is difficult for management to assess effectiveness and determine areas for improvement in the use of these technologies for sustainability aims (Bekaroo et al., 2018).

The importance of using technology to increase environmental awareness in the workplace cannot be overlooked. Technology, as an integral part of everyday life, has great potential to change the behavior and mindset of individuals, including among employees. As part of company social responsibility, adopting technology that supports environmental awareness can reduce negative environmental impacts and strengthen an organization's reputation for sustainability a critical intangible asset in the digital age where corporate image is highly vulnerable yet manageable through strategic communication (Darmawan et al., 2022). Given the importance of each individual's contribution in preserving the earth, this study on the use of technology in sustainability has high relevance to help create greater change at the social and organizational levels (Yun et al., 2013).

The aim of this study is to analyze how technology, such as mobile-based applications and digital platforms, can be used to increase environmental awareness in the workplace, as well as identify factors that influence the level of employee adoption and participation in technology-based sustainability initiatives. By digging into the constraints and opportunities that exist, it is hoped that solutions can be found that can encourage the use of technology more effectively in supporting environmental sustainability in various organizations.

RESEARCH METHOD

The literature study approach in examining the use of technology to increase environmental awareness in the workplace is one of the effective methods to gain an in-depth understanding of this topic. The literature study refers to the collection and analysis of various relevant sources to understand how technology, such as applications and digital platforms, can be used to achieve sustainability goals in organizations. This approach also helps identify the challenges faced by companies in integrating technology into their sustainability initiatives. As a descriptive research method, literature study giving an opportunity to synthesize information from various disciplines and present findings that can

giving practical insights for policy makers and practitioners in the field of human resource management (Crowley, 2007).

The sources used in this literature study include journal articles, books, organizational reports, and other academic publications that focus on the role of technology in sustainability and environmental awareness in the workplace. In selecting these sources, the authors focused on research that directly addresses the use of apps and digital platforms by organizations to encourage employee participation in sustainability initiatives. By analyzing previous studies, it is possible to understand the various factors that influence the level of technology adoption and employee participation, including aspects of motivation, accessibility of technology, and the effectiveness of digital platforms in delivering sustainability messages (Oliver, 2014).

The process of synthesizing information conducted in this literature study allowed the authors to generate evidence-based recommendations, while also evaluating how technology can be optimized in order to strengthen environmental awareness in the workplace. One of the advantages of this approach is its ability to bring together perspectives from various studies that have been conducted across different organizations and sectors (Contreras Sanabria et al., 2017). This literature study also giving an overview of recent trends in the use of technology for sustainability, such as the use of cloud-based technologies, mobile applications for energy consumption monitoring, and digital platforms for environmental performance reporting.

RESULT AND DISCUSSION

In this modern era, the workplace is becoming an environment that is increasingly concerned with issues of sustainability and environmental impact. Companies are not only focused on financial returns, but also on their social and environmental responsibilities (Atiku, 2019). One of the most effective ways to increase sustainability awareness is by utilizing technology, which enables a more structured, transparent and efficient approach. Technology offers various tools, such as applications and digital platforms, that can be used to educate, motivate and engage employees in sustainability initiatives. Through these platforms, employees can better understand and participate in the company's efforts to reduce carbon footprint, manage energy, and minimize waste (Law et al., 2017).

Companies that successfully implement technology to increase environmental awareness in the workplace, not only focus on the internal aspects of the organization but also strengthen relationships with customers and societies. This shift is in line with the need to accommodate social changes in sustainability policies, in order to create broader relevance and fairness at the community level (Halizah & Mardikaningsih, 2022). Technology-based applications giving easy access and data collection related to environmental management, which can increase transparency and accountability. The use of technology allows employees to engage in sustainability programs in a more fun and interactive way. This not only encourages behavioral change in the short term but also creates a more environmentally conscious culture in the long-term (Ahmed et al., 2019).

Through technology, companies can more effectively engage individuals to play an active role in increasing sustainability awareness and action. This approach has the potential to encourage innovation in the field of environmental management in the workplace, while creating a positive impact on the organization (Oke, 2022). Understanding how technology can be used to strengthen sustainability efforts is an important step in creating companies that are not only productive but also environmentally responsible. However, to ensure these positive impacts, the technology must be developed and implemented ethically and fairly (Radjawane & Mardikaningsih, 2022).

Using technology to increase environmental awareness in the workplace and optimize employee participation in sustainability initiatives requires a strategic approach that combines digital tools with policies that support a culture of sustainability. Digital technologies, such as mobile applications, e-learning platforms, and social media which has been recognized for its significant potential as a powerful communication and promotion tool (Infante & Mardikaningsih, 2022) can be used to disseminate relevant environmental information in an interesting and accessible way. Crucially, these platforms do not just transmit information; they are spaces where interactions can shape self-identity and social perceptions, influencing how individuals internalize and act upon sustainability values (Costa et al., 2022). Applications that allow employees to track their personal carbon footprint or to participate in energy saving challenges can give strong incentives for engagement (Oppong-Tawiah et al., 2018). One example of the use of technology is an application that allows employees to measure their energy consumption at work and compare it with their peers, creating a kind of healthy competition to reduce energy use.

Digital-based platforms enable companies to

provide sustainable education on sustainability issues through e-learning modules that can be accessed at any time by employees. This approach is in line with strategies to encourage sustainable behavioral change, in which accessible education and awareness raising play a key role (Gautama & Mardikaningsih, 2022). In this way, employees can be engaged in learning programs that increase their understanding of the importance of sustainability without having to disrupt their work time. These technology-based training programs can include topics such as waste management, carbon emission reduction, or simple ways to save energy in the office (Yalina & Rozas, 2020). This will strengthen their knowledge of sustainability, while reducing barriers to accessing sustainability-related information.

Further technological innovations can also be used to create direct feedback systems on individual contributions to sustainability initiatives. The application of such innovations is a concrete manifestation of a technology strategy that aims to create sustainable value, as is the focus in the development of globally oriented products (Mardikaningsih & Hariani, 2023). For example, the use of Internet of Things (IoT) devices that can monitor the use of energy, water, and other materials in the workplace can inform employees about how much their habits impact daily activities. This technology enables companies to provide real-time reports to employees on their environmental performance, which in turn motivates them to participate more actively in sustainability programmed (Andrade et al., 2015). This also leads to greater transparency and accountability in managing sustainability initiatives.

Gamification, or the integration of game elements into organizational sustainability programmed, offers a psychological and technical framework for systematically increasing employee motivation and participation. Through game-based applications, employees can engage in interactive sustainability challenges such as plastic waste reduction or energy efficiency competitions that transform abstract environmental goals into concrete and measurable experiences. Thus, gamification serves not only as a means of entertainment, but also as a persuasive mechanism that encourages behavioral change through direct feedback, incremental achievements, and competitive social dynamics.

Strategically, the gamification approach is a transformative instrument for internalizing sustainability values into organizational culture, in line with efforts to build an inclusive work environment that simultaneously boosts company performance and competitiveness (Mardikaningsih & Hariani, 2022). The implementation of an integrated reward system within the application which explicitly recognizes employees' contributions to reducing environmental impact not only creates a dynamic of healthy competition but also strengthens collective identity as agents of change (Ro et al., 2017). This mechanism is a concrete manifestation of environmental accountability, which is built not only through legal obligations, but also through ethics, responsibility, and morals that are integrated into the organization's incentive system (Darmawan, 2022). Through this mechanism, gamification evolves from a mere engagement tool into a cultural infrastructure that links sustainability with work identity, accountability, and organizational rewards.

The use of technology also allows companies to optimize internal communication on sustainability. This is particularly crucial in the context of formulating and implementing business sustainability strategies, especially when faced with regulatory uncertainty and managerial challenges that require consistent and transparent dissemination of information (Mardikaningsih & Darmawan, 2021). Through digital communication platforms such as the company intranet, email or cloud-based applications, employees can regularly receive updates on ongoing sustainability initiatives. This system ensures that important sustainability-related information is widely disseminated throughout the organization and not just limited to certain groups. The information contained in these digital platforms can be accessed by employees at any time, giving them the flexibility to stay informed without work time constraints (Kotsopoulos et al., 2017).

The application of technology for sustainability also needs to be adjusted to the level of technological literacy of employees. Not all employees have sufficient technological knowledge or skills to utilize sustainability applications effectively. It is important to ensure that training on how to use these technologies is available to all employees. This training should not only include an introduction to the application or platform being used, but also ways for them to understand the data being generated and how they can change their behavior based on the information provided (Gomez, 2011). This is important to avoid gaps in access and understanding among employees.

The principle of inclusivity is the ethical and strategic foundation for utilizing technology to support sustainability initiatives in the workplace.

This commitment requires companies to ensure that all employees, regardless of role, location, or technical background, can access and participate meaningfully. Without universal access design, technology has the potential to deepen participation gaps and undermine the overall effectiveness of sustainability programmed.

The implementation of this accessibility principle requires the selection and development of digital platforms that are responsive, lightweight, and compatible with a variety of devices from office computers and personal smartphones to tablets while also being supported by an intuitive user interface (Krishnakumaryamma & Venkatasubramanian, 2018). With this approach, technology becomes not only a tool for disseminating information, but also an infrastructure for democratization that enables the internalization of sustainability values across all levels of the organization, thereby building a more resilient and sustainable corporate culture.

Evaluating the success of using technology for environmental awareness in the workplace needs to be done regularly. Composing clear and measurable performance indicators will allow organizations to see how effective the technology is in encouraging environmental awareness. This process aligns with the broader principle that the application of information technology and user competencies must be systematically measured to understand their true impact on organizational performance (Djaelani et al., 2020). The data from this systematic evaluation then became an important basis for the Human Resources (HR) function in formulating and managing environmental policy strategies to create a sustainable organization and improve company performance (Hariani et al., 2022). For example, was there a significant decrease in energy use or waste after the technology was introduced? Was there an increase in employee participation in environmental programs after the training or application was launched? Through structured evaluation, companies can make more informed decisions in increasing and developing technologies that support sustainability in the future (Grabot & Schlegel, 2014).

Companies should also consider building collaborations with external parties, such as Non-Governmental Organizations (NGOs) or organizations that focus on environmental issues. These collaborations can help provide more resources, as well as enrich the content or initiatives offered to employees (Chugh et al., 2016). For example, inviting speakers or facilitators from environmental organizations to talk about sustainability or discussing further ways to utilize technology in increasing awareness about environmental problems.

A technology-based approach to sustainability in the workplace not only helps companies to reduce their environmental impact, but also encourages employees to feel more engaged and responsible for their actions. By giving the needed tools and knowledge, technology enables employees to more easily participate in environmental initiatives and improve their behavior in their daily lives (Jenkin et al., 2011). Technology serves not only as a tool to monitor and measure, but also as a catalyst for broader changes towards sustainability in the workplace.

Through the development of policies that support the use of technology and employee participation in sustainability initiatives, companies can create a more environmentally friendly culture. These policies should include providing incentives, training, and the needed resources to ensure that every employee can access and utilize technology properly (Kunkel & Matthess, 2020). Thus, sustainability is not only the responsibility of the company, but also a shared responsibility that can be pursued by all members of the organization.

As awareness about climate change and sustainability increasingly, companies around the world are looking for ways to adapt to developing environmental demands. Technology can be an invaluable tool for achieving broader sustainability aims. By utilizing technology, companies not only increase awareness about sustainability in the workplace, but also optimize employee participation in these initiatives. Technology giving a way to access, monitor and optimize environmental practices more efficiently, while supporting the development of a culture of sustainability within the organization (Saini, 2022).

The success of technology as a tool to support sustainability in the workplace is not only determined by the sophistication of its features, but also by the extent to which it can be accessed and utilized by the entire spectrum of employees. An inclusive approach to technology implementation is a key prerequisite, as it ensures that every individual regardless of their level of digital literacy, job role, or resource limitations can be meaningfully involved and contribute to the company's sustainability efforts (Simmonds & Bhattacherjee, 2012).

Without a commitment to inclusivity and accessibility that is carefully designed, technology risks creating or exacerbating fragmentation in participation. This gap can not only hinder the achievement of collective sustainability goals, but

also erode the sense of fairness and shared ownership of the organization's green agenda. Therefore, integrating inclusive design principles from the outset is no longer merely an ethical choice, but a strategic imperative to ensure that technology truly serves as a unifier, rather than a divider, on the journey towards sustainable transformation.

To address this issue, an integrated approach is needed that combines systematic technology training with ongoing engagement programmed. This combination not only improves employees' digital literacy, but also creates an environment that encourages active participation in green initiatives. In this context, the strategic role of the Human Resources (HR) function becomes crucial, as it is responsible for designing and implementing relevant competency development programmed.

The HR function plays a central role in building capacity and closing the skills gap needed to support the organization's transition to more sustainable practices (Essa & Mardikaningsih, 2023). Through appropriate training and continuous mentoring, technology can be optimally utilized to raise environmental awareness, encourage behavioral change, and accelerate the adoption of environmentally friendly practices at all levels of the organization, thereby creating a broader and more sustainable impact.

In the future business landscape, technology will serve as a strategic backbone that integrates environmental awareness into the operational DNA of companies. Its role goes beyond instrumental functions, evolving into a digital ecosystem that proactively shapes behavior, measures impact, and facilitates sustainability accountability at both the individual and team levels. This transformation necessitates a reconfiguration of management systems, where real-time data flows on environmental performance become the basis for decision-making and employee competency development.

Transformative impacts will only be systemic when technological advances are synchronized with structural commitments reflected in resource allocation, incentive design, and organizational performance evaluation systems. This convergence enables the creation of circular business models that not only minimize negative impacts on the environment, but also generate added value for stakeholders through transparency, green innovation, and anticipatory regulatory compliance. Thus, sustainability transitions from being merely a complement to becoming a key driver of organizational competitiveness and resilience in a low-carbon economy.

To achieve the necessary scale of impact, sustained investment in enabling technologies must be combined with a governance framework that ensures inclusivity, digital literacy, and shared ownership of the green agenda. Technology without holistic human empowerment will only deepen the participation gap. Therefore, long-term success depends on the ability of companies to transform every employee through education, engagement, and responsible autonomy into agents of change who internalize and champion sustainability not only in the workplace, but also in their social networks and the wider ecosystem.

CONCLUSION

The use of technology to increase environmental awareness in the workplace is crucial in meeting today's sustainability challenges. Digital applications and platforms can accelerate behavior change by giving clear, accessible information and encouraging employees to actively engage in sustainability initiatives. With technology, companies can optimize environmental management, from reducing carbon footprints to more efficient energy management. Technology giving the opportunity to create more fun and personalized interactions with employees about sustainability, so they feel more engaged and motivated to support these efforts.

For these technologies to be effective, it is important for companies to ensure that the platforms used are easily accessible to all employees and giving adequate training. To that end, it is important to ensure that the use of technology is not only limited to data collection or supervision, but also creates an environment where every individual feels they have a contribution to make in sustainability efforts. Going forward, companies need to develop and customize technology according to employee needs and increase their awareness of the long-term benefits of sustainability together. With this step, it is hoped that companies will not only achieve better environmental aims, but also create a culture that cares more about sustainability.

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