

Role of Technology in Assisting Green and Sustainable Business Practices: An Empirical Study

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Abstract

An environmentally mindful business goes beyond just profit-making; it takes into account its societal and environmental impact as well. These businesses aim for sustainability, and contributes towards the overall health of the ecosystem in which it operates, thus creating an environment conducive to its own success. The innovation of green technology is geared to achieve long-term sustainable development by delivering economic, environmental, and social advantages, preserving resources and energy, and minimizing environmental pollution and degradation. Technologies play a crucial role in addressing the fundamental pillars of sustainability—people, planet, and profit. As an outcome, many businesses are implementing sustainable development by integrating technology into their business practices. This shift towards sustainability is apparent as more businesses are striving to become socially responsible, implementing principles, policies, and practices that enhance the well-being of their customers, employees, communities, and the environment. This collective effort fosters the creation of a more eco-friendly and sustainable economy. A sample of 289 respondents was collected from people working in business sector. The variables that identify the Role of technology are Resource Management, Green Product Development, Environmental Monitoring, and Renewable Energy Integration.

Keywords: Information Technology, Sustainability, Green business, sustainable development

Introduction

While many businesses acknowledge the potential of Technology in enabling sustainability efforts, there is a lack of comprehensive studies that research into the specific role technology can play in supporting initiatives of sustainability. Moreover, practical examples demonstrating how technology can efficiently support all three pillars of sustainability within an organization are comparatively rare. For any business organization with the aim to address and boost its environmental impact, a strategic re-engineering of business operations is imperative to adopt practices that align with environmental dimensions (**Rivera & Kurnia, 2015**). In present business environment, digital transformation towards sustainability is dominant. Micro-small and medium-sized enterprises can influence sustainability as a competitive edge, attractive to customers and investors who prioritize these values. Implementation of sustainable practices not just enables these businesses to drive innovation but also leads to cost savings and an improved reputation. To kickstart a sustainable digital transformation, businesses must concentrate on reshaping their organizational culture, embracing big data technologies, and actively involving stakeholders to foster innovation (**Martínez-Peláez et al. 2023**). The factor like Technology, Organization, and Environment

plays a crucial role in driving green practices such as green training and green performance appraisal that ultimately make contribution towards sustainable performance results. These findings must encourage businesses to make more emphasis on internal technological and organizational factors, fostering an eco-friendly culture that motivates stakeholders to adopt a more favourable environmental attitude. Implementing policies of recruitment that prioritize environmental responsibility and commitment demands SMEs to invest substantial time and effort in sustainable development, particularly during the pandemic. This involves paying closer attention to environmental and societal values associated with sustainable development (**Alraja, Imran, Khashab, & Shah, 2022**).

Literature Review

Shafiei & Abadi (2017) studied that environmental protection, resource conservation, and addressing socio-economic aspects for sustainable development are vital. Green initiatives intend at preserving resources and protecting the environment can sustain a higher economic growth rate essential to meet basic requirements with an acceptable quality of life in future. Sustainable development that respects social equity and environmental health, can only occur with increased international awareness and significant shifts in production and consumption patterns.

Zhu et al. (2023) revealed that green product innovation serves as a mediating factor between adoption of green technology and green competitive advantage, as well as between capabilities of green dynamic and green competitive advantage. Author suggested in the study that businesses stand to benefit from prioritizing the adoption of eco-friendly technologies and nurturing dynamic capabilities to enhance their green performance. By creating innovative green products, companies can set themselves apart from competitors, appeal to environmentally conscious consumers, and expand their market presence. These findings highlight the importance of integrating sustainability considerations into organizational capabilities, which has substantial implications for small and medium size businesses, startups, and their management teams.

Soderholm (2020) stated that green economy represents a different approach to growth and development, with the aim to create economic progress and enhance lives of people's while also encouraging environmental and social well-being. A key component of this strategy is to inspire the advancement and adoption of sustainable technologies. While private companies may not be projected to violently follow green innovations, governments frequently invest substantial resources in researching and developing pollution reduction technologies. However, government programs that fund research on technologies allowing policy implementation and environmental monitoring are less common.

Shahzada, Qu, Rehman & Zafar (2022) found that recent progress in green and innovative technologies has glimmered numerous innovations in business operations with the aim to accelerate sustainable development. Despite several advantages of implementing green innovation, the adoption rate of these initiatives remains ineffectively low in business organizations. The discussion around sustainable innovation is gaining grip as many countries strive to meet sustainable development objectives in the future decade. It's clear that realizing the Green Innovation dream is dependent upon embracing green practices and leveraging the latest innovative technologies.

Huang et al. (2022) stated that today's business organization are utilizing digital green innovations in manufacturing to support their journey towards sustainability through the adoption of sustainable development practices. This work shows that prioritizing investment and implementation of cutting-edge technology and sustainable practices are critical to ensure long-term success. However, it is vital to note that soft issues such as organizational information management are similarly essential in today's information-based economy.

Hmoud Al-Faouri (2023) revealed that in the modern business environment, the blend of green knowledge management and technology has appeared as a crucial element for businesses to fulfil the evolving expectations of environmentally-conscious consumers. Research findings suggest that green knowledge management makes a significant influence on sustainability of business, with knowledge-based leadership acting as a mediator in this relationship.

Utaminingsih, Priyanto, Ihalauw & Kusuma (2020) studied that institutional environment plays an important role in shaping the green business behaviour, entrepreneurial orientation, and adoption of green technologies by small and medium sized businesses. Moreover, the findings of this work shows that entrepreneurial orientation makes a significant effect on green business behaviour and sustainability focus both. Moreover, the adoption of

green technologies has a notable impact on green business behaviour and sustainability focus. The behaviour of green businesses makes substantial impact on the sustainability focus of business organization.

Madkhali & Sithole (2023) found a significant trend towards green initiatives in the country, marked by the adoption of technologies like the Internet of Things, blockchain, and artificial intelligence. These technologies have played a vital role that improves energy efficiency and reducing waste. They have proven to be instrumental in promoting environmental sustainability and driving economic growth.

Mohammed (2021) revealed that green technology refers to the application of science and technology to produce products that are environmentally friendly and less harmful to the planet. Its primary goal is environmental protection, which includes clean energy production using alternative technologies and fuels that do not harm the environment. This technology extends to infrastructure solutions such as clean energy generation, waste recycling, water purification, and conservation of natural resources. Many countries are prioritizing the advancement of their economies and the well-being of their citizens by fostering a healthy environment through a thorough understanding and adoption of green technology.

Zhang, Gao & Li (2023) found that intersection of green development and the digital economy is gaining significant attention from scholars, practitioners, and policymakers due to the unclear link between the two. Addressing the study of mechanisms between them for achievement of higher-quality economic development is deemed urgent. Digital transformation is highlighted as a key avenue for enterprises to attain high-quality development. This study contributes by examining the enabling effects of digital transformation, expanding the antecedents of green technology innovation, and investigating the mediating effects of green dynamic capabilities in enhancing green technology innovation during digital transformation processes.

Jaksic (2016) observed that the complete scope of technology management includes the combination of technological considerations into all facets of business development. We introduce the “SEP” model that begins and ends with considerations of societal and environmental conditions, aims, and goals. Technology plays a crucial role in driving economic dynamics for businesses that enables them to improve business operations and create new value through goods and services, thus making contribution in increasing social benefits and welfare. The principles of sustainable development are instrumental that shapes a fresh business philosophy with novel dimensions.

Singh, Verma & Verma (2020) revealed that Green Technology plays a vital role in preservation of renewable resources for future generations. While progress has been made in this area, there is still much to do. Implementation of Green Technologies might need substantial investment and purpose, but many businesses have already taken the initiative to adopt eco-friendly practices. It is imperious for other business organizations, regardless of size, to recognize their responsibility in making the Earth greener and embrace the challenge of Green Technology. The advantages of adopting Green Technology are significant, particularly if businesses take action now. As humans, we have the capability of thinking critically, and it is important that we consider the significances of our actions and fulfil our supreme duty of preserving the Earth for future generations.

Bhagat, Naz & Magda (2022) studied that rapid emergence of artificial intelligence and its increasing effect across various sectors demands an assessment of its effect on attaining the Sustainable Development Goals. It is vital to guarantee that the fast-paced development of AI is accompanied by suitable regulatory error to enable sustainable development. Overlooking this aspect could lead to gaps in transparency, safety, and ethical standards. While developed economies have an edge in utilization of AI, there is a need to enhance its role in developing countries. Technologies like big data analytics and the Internet of Things are composed to drive digital transformation that enables business firms to enhance productivity and efficiency in a green and sustainable manner.

Kiradoo (2018) stated that as climate conditions are evolving and external factors are becoming more complicated, the incorporation of green initiatives into the global economy has gained noteworthy urgency. This is related to sectors such as hospitality, tourism, manufacturing, and agriculture. The stress is now on leveraging technology for efficient management of resource utilization and waste across such industries. The rise of technologies has appeared as a strong means of communication the importance of sustainability, empowering businesses to establish a wider and more influential platform to disseminate information and creating more awareness about this crucial matter.

Monga (2018) studied that the term "green business" covers a complete business strategy that focus on minimization of adverse effects on the environment, community, society, or economy while staying profitable. However, there is no universally accepted definition, and it is advisable for every business firm to define its own criteria for being green and establishing a set of actions or standards to follow, including efficiency of resources. Over the past twenty-five years, global environmental challenges such as air pollution, ozone depletion, hazardous waste, water pollution, and global warming are becoming highly critical. Urgent action is required to address all such issues and sustain our ecosystem.

Objective

To identify the “Role of Technology in assisting green and sustainable business practices”.

Study’s Methodology

289 respondents are considered for this study which was collected from people working in business sector. Random sampling method was used to collect data and examined by “Explanatory Factor Analysis” for results.

Findings of the Study

Below table shows demographic details of participants it shows that 58.82% are male, and 41.18% are female participants. Regarding age of the respondents, 35.64% are between 35 to 40 years, 30.79% are 40 to 45 years, and 33.57% are above 45 years of age. About Business Industry type, manufacturing are 28.72%, telecom are 39.10, and retail business are 32.18%.

Details of Participants

Variable	Participants	% age
Gender		
Male	170	58.82
Female	119	41.18
Total	289	100
Age in years		
35 to 40	103	35.64
40 to 45	89	30.79
Above 45	97	33.57
Total	289	100
Business Industry		
Manufacturing	83	28.72

Telecom	113	39.10
Retail business	93	32.18
Total	289	100

“Factor Analysis”**“KMO and Bartlett's Test”**

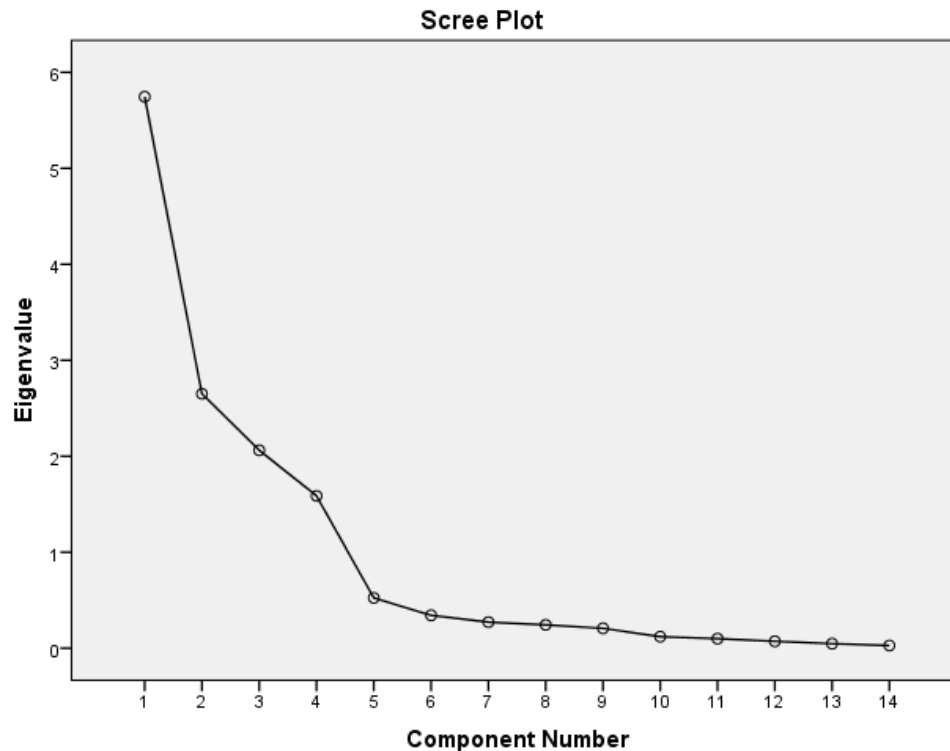
“Kaiser-Meyer-Olkin Measure of Sampling Adequacy”		.789
“Bartlett's Test of Sphericity”	“Approx. Chi-Square”	4464.199
	df	91
	Significance	.000

In above table “KMO and Bartlett's Test” above, KMO value found is .789

“Total Variance Explained”

“Component”	“Initial Eigenvalues”			“Rotation Sums of Squared Loadings”		
	“Total”	“% Of Variance”	Cumulative %	“Total”	“% Of Variance”	Cumulative %
1.	5.745	41.038	41.038	3.749	26.778	26.778
2.	2.651	18.934	59.972	3.575	25.537	52.315
3.	2.062	14.730	74.702	2.455	17.538	69.853
4.	1.587	11.335	86.037	2.266	16.184	86.037
5.	.524	3.744	89.781			
6.	.342	2.446	92.227			
7.	.272	1.941	94.168			
8.	.243	1.738	95.906			
9.	.207	1.480	97.386			
10.	.120	.855	98.242			
11.	.100	.711	98.953			
12.	.072	.513	99.465			
13.	.047	.336	99.802			
14.	.028	.198	100.000			

All the four factors are making contribution in explaining total 86.037% of variance. The variance explained by Resource Management is 26.778%, Green Product Development is 25.537%, Environmental Monitoring is 17.538%, and Renewable Energy Integration is 16.184%.



ScreePlot

“Rotated Component Matrix”

S. No.	Statements	Factor Loading	Factor Reliability
	Resource Management		.977
1.	Technologies help businesses monitor and manage consumption of resources	.959	
2.	Smart energy meters can track electricity usage, allowing businesses to optimize energy consumption	.947	
3.	Green initiatives intend at preserving resources and protecting the environment	.938	
4.	Green initiatives preserve resources and protect the environment sustain a higher economic growth rate	.935	
	Green Product Development		.959
1.	It serves as a mediating factor between green technology and green competitive advantage	.954	

2.	By creating innovative green products, companies can set themselves apart from competitors	.922	
3.	Green management concentrates on environment leading to business firms to promote green products	.903	
4.	Simulation of technologies helps in designing and testing green products	.878	
	Environmental Monitoring		.887
1.	IoT devices and remote sensing technologies monitor environmental parameters	.904	
2.	Adoption of technology helps in monitoring air quality, water quality, and biodiversity	.861	
3.	It helps in providing valuable data for conservation efforts and sustainable land management	.860	
	Renewable Energy Integration		.826
1.	Renewable energy technologies such as solar panels, wind turbines, and energy storage systems	.898	
2.	Technology allows businesses to transition to cleaner energy sources	.843	
3.	Smart grids and microgrid solutions enhance the efficiency and reliability of renewable energy integration	.796	

Factors and the associated variables

The first factor of the study is Resource Management, the variables included in this study are Technologies help businesses monitor and manage consumption of resources, Smart energy meters can track electricity usage, allowing businesses to optimize energy consumption, green initiatives intend at preserving resources and protecting the environment, and green initiatives preserve resources and protect the environment sustain a higher economic growth rate. Green Product Development is the second factor of the study, it includes variables like It serves as a mediating factor between green technology and green competitive advantage, by creating innovative green products, companies can set themselves apart from competitors, green management concentrates on environment leading to business firms to promote green products, and Simulation of technologies helps in designing and testing green products. The third factor is Environmental Monitoring, the variables it includes are IoT devices and remote sensing technologies monitor environmental parameters, Adoption of technology helps in monitoring air quality, water quality, and biodiversity, and it helps in providing valuable data for conservation efforts and sustainable land management. Renewable Energy Integration is the last and fourth factor of the study, Renewable energy technologies such as solar panels, wind turbines, and energy storage systems, Technology allows businesses to transition to cleaner energy sources, and Smart grids and microgrid solutions enhance the efficiency and reliability of renewable energy integration are the variables that it includes.

“Reliability Statistics”

“Cronbach's Alpha”	“Number of Items”
.880	14

Total reliability of 14 items that includes variables for Role of Technology in assisting green and sustainable business practices is 0.880

Conclusion

Recent developments in green and innovative technologies have led to several innovations in business operations that have accelerated sustainable development. The sustainable innovation discourse is gaining power as many nations are aiming to achieve Sustainable Development Goals in the next era. Developing economies are progressively adopting digitalization, automation, and technologies in business operations that would offer substantial competitive advantages in the global market and increase the adoption of Industry 4.0 practices in local business firms, thereby improving their performance. Research specifies that mixing big data into business processes would enable the implementation of green practices, while implementation of the Internet of Things can further enhance green initiatives and enhance overall performance. Green management concentrates on sustainability of environment that would lead to substantial transformations that would lead to business firms to promote green products, operations, and facilities, hence rotating sustainability into a competitive advantage. Embracing green innovations helps in maintaining a healthy and clean environment by utilizing services, products, and technologies that minimize negative impacts on natural resources. Understanding the positive effects of these innovations is vital, as it updates people about the advantages in their lives and businesses that also includes cost savings, improved health from using green products, and contributing to a healthier planet. The variables that identify the Role of technology are Resource Management, Green Product Development, Environmental Monitoring, and Renewable Energy Integration.

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