

AUTOMATION & RPA (ROBOTIC PROCESS AUTOMATION) IN GREEN ACCOUNTING: A NEW ERA OF ENVIRONMENTAL EFFICIENCY

S. RAVI SHANKAR

Assistant Professor

Koshys Institute of Management Studies, Bengaluru

s.ravishankar@kgi.edu.in

CHEMMUGIL P.

Assistant Professor

Garden City University, Bengaluru

chemmugil@bicpu.edu.in

Abstract

This article discusses the growing role that Automation and Robotic Process Automation, popularly referred to as RPA, and are playing to help reinforce green accounting for modern organizations. With evolving demands for environmental reporting, organizations must manage large volumes of data associated with energy use, waste produced, resource consumption, and emissions. Manual processes tend to foster inefficiency, error, and delays. RPA overcomes these problems through the automation of data gathering, data validation, data processing, and reporting, therefore improving precision, speed, and reliability of environmental reporting. The article stresses the most essential RPA applications, such as automated carbon calculations, sustainability dashboards, regulatory submissions, and real-time environmental monitoring, among others. At the same time, it proceeds to analyze the challenges connected with its implementation, integration, and requirements for skills. It is concluded that RPA will shape a sustainable future for business in combination with emerging technologies like Artificial Intelligence, IoT, and block chain by providing smarter, transparent, and effective environmental accounting systems.

Keywords: automation, artificial intelligence, environmental efficiency, green accounting

1. INTRODUCTION

As care for the environment is taken to the global stage, organizations are increasingly embracing green accounting in an effort to report, measure, and track their environmental impact. However, green accounting entails extensive data collection regarding energy use, waste generated, emissions, biodiversity measures, and regulatory compliance. Managing such a diversity of datasets manually involves processes that are time-consuming, prone to errors, and highly resource-intensive. This is where automation and RPA are completely changing the game. With digital tools and bots, the management of environmental data becomes easier, reporting becomes more accurate, and sustainability performance is accelerated for companies. Automation is not merely replacing repetitive tasks but is reshaping how companies measure and manage their ecological footprint.

1.1 Concept of Green Accounting

Green accounting is a method that incorporates environmental costs, benefits, and impacts into the conventional system of financial accounting. It perceives air, water, land, forests, and biodiversity as assets and measures the effect of business activities upon them. Based on quantification of resource utilization, depletion, pollution, waste management, and carbon emissions, green accounting provides a holistic view of the environmental performance of an organization. It also captures environmental benefits like energy savings, recycling gains, and renewable energy adoption. By being holistic in their approach, businesses and governments are able to make informed decisions, meet

sustainability regulations, and align towards ESG standards. In the long term, green accounting links environmental responsibility with economic sustainability.

2. REVIEW OF LITERATURE

Recent literature identifies a fast-developing trend to include more automation, digital tools, and data-driven technologies into green accounting to improve the accuracy of environmental reporting and performance of sustainability. According to a study undertaken by the Global Reporting Initiative (2023), it is approximated that using automation and digital sustainability platforms increases the quality and reliability of ESG disclosures, thereby enabling organizations to arrive at global compliance frameworks with increased efficiency. According to the World Bank (2022), automated environmental data systems, such as digital tracking of emissions and IoT-based monitoring, improve national and corporate environmental performance through reduced human errors and real-time assessment of eco-metrics. The United Nations Environment Programme (UNEP, 2023), on its part, underscores the role of AI, machine learning, and smart sensors in responding to emerging needs for improved environmental governance through automated verification of data, predictive analytics of environment-related trends, and early warnings against ecological risks.

Industry-focused studies prove that carbon accounting software powered by automation provides more accurate carbon inventories to support corporate net-zero strategies. For example, the CDP Global Environmental Report (2023) mentions that companies with automated carbon management platforms have faster and more consistent carbon emission calculations, even as auditability improves. Research by Deloitte (2022) and PwC Sustainability Insights (2023) illustrates the usage of AI-enabled sustainability dashboards, RPA-based data collection, and digital twins to drastically reduce reporting time while increasing supply chain transparency. In this respect, blockchain-based environmental accounting-as mentioned in the reports by OECD (2023) offers tamper-proof records of carbon credits, flows of waste, and renewable sources of energy that help in mitigating greenwashing. Overall, the literature consistently indicates that automated green accounting practices offer substantial advantages over traditional methods by enhancing precision, transparency, and decision-making capabilities. These technologies support standardized ESG reporting, improve regulatory compliance, and provide organizations with advanced tools to track environmental performance in real time ultimately contributing to more credible and efficient sustainability management.

3. TRENDS IN GREEN ACCOUNTING

Green accounting, powered by advanced technologies and higher expectations of sustainability, is evolving rapidly. The key trends include automation, RPA, IoT sensors, and AI use in order to provide accurate and real-time environmental data management, with a rise in standardization of ESG and sustainability reporting. Carbon accounting, net-zero commitments and circular economy practices are being adopted by organizations, and blockchain is improving transparency in carbon credits and value chains. Mandatory environmental disclosure, sustainability-linked financial reporting, and green auditing are reinforcing accountability further. Combined, these trends are making green accounting more data-driven, transparent, and integral to corporate decision-making.

3.1 Scope of Data Analysis in Automated Green Accounting Practice

Data analysis thus helps solidify automated green accounting practices by converting environmental data into actionable insights. With state-of-the-art systems like

IoT sensors, RPA tools, and AI-fuelled sustainability platforms as the source, vast volumes of real-time environmental information can be used by an organization to undertake in-depth analytics assessments. Included are key components such as carbon emission trend analysis to help identify patterns of peak emissions; comparative studies of energy consumption and productivity that provide measures of efficiency gains derived through automation; and cost-benefit analyses to quantify the financial and environmental gains of automated systems. Predictive analytics, underpinned by machine learning models, facilitates forecasting of future resource consumption and potential environmental hazards, while waste and supply chain analytics pinpoint operational inefficiencies and areas where intervention is needed. Integration of these analytics techniques in automated green accounting enhances the accuracy, transparency, and strategic value of sustainability decisions and enables organizations to better meet regulatory and ESG reporting standards.

3.2 Regulations and their link to green accounting

India has established several laws, regulations, and frameworks that guide companies in environmental management, reporting, and green accounting. These norms aim to integrate environmental responsibility into corporate operations and promote sustainable development.

Table 1: Regulations and their Link to Green Accounting

Regulation / Framework	Key Requirement	Relevance to Green Accounting
Companies Act, 2013 – Section 135 (CSR)	Spend $\geq 2\%$ of net profit on CSR; disclose CSR activities	Tracks environmental initiatives and spending; included in annual reports
National Green Tribunal (NGT) Regulations	Enforce environmental compliance; monitor pollution	Companies report sustainability practices and environmental measures
Environmental Protection Act, 1986	Pollution control, waste management, emission monitoring	Green accounting helps track and report compliance data
Energy Conservation Act, 2001	Mandatory energy audits for certain sectors	Records energy consumption, efficiency measures, and savings
MCA – Business Responsibility Reporting (BRR)	File ESG/BRR covering energy, water, emissions, sustainability	Green accounting provides accurate environmental performance metrics
SEBI – ESG/Sustainability Disclosure Guidelines	Top 1,000 listed companies report ESG performance	Supports disclosure of energy, water, emissions, and waste data
ISO and Voluntary Standards (ISO 14001, GRI, ESG)	Voluntary environmental management and sustainability reporting	Automation ensures accurate measurement and reporting
Carbon Credit & Renewable Energy Norms (PAT, RECs)	Reduce emissions, adopt renewable energy, trade carbon credits	Tracks emissions reduction and renewable energy usage for compliance

3.3 Automated Green Accounting Practices in India

Data analysis lies at the heart of automated green accounting today. In essence, IoT sensors, RPA tools, AI, and cloud-based platforms will enable organizations to track, analyze, and act upon crucial sustainability metrics instantaneously. Tata Steel has integrated IoT sensors that feed data on energy consumption, GHG emissions, water usage, and other key environmental parameters from the plants onto the AI-enabled dashboards for real-time reporting and operational efficiency. Infosys has put in place automated energy management systems and predictive analytics on campuses to bring down electricity and water consumption, adhering to ESG reporting standards. Mahindra

& Mahindra integrates IoT and RPA within its manufacturing operations, enabling the tracking of resource usage and generation of waste from operations and optimizing processes for energy efficiency and reduction of carbon footprint. Further, ITC Ltd. is implementing automated carbon accounting and digital dashboards across its supply chain for sustainability efforts, increasing transparency and applying due compliances to regulatory and CSR norms. These stand as vivid examples of how Indian companies are incorporating automation and data analytics into their business models for sustainable growth, meeting environmental regulations, and improving corporate social responsibility outcomes.

3.4 Estimated Cost Factors and ROI in Automated Green Accounting

Table 2: Estimated Cost Factors and ROI in Automated Green Accounting

Cost Component	Description	Approximate Cost Range	Expected ROI / Benefits
Software Licenses	RPA tools, AI-based analytics, ERP integration, carbon accounting platforms	₹5-20 lakh / \$6,000-25,000 (SME); ₹50 lakh+ / \$60,000+ (large enterprise)	Automates repetitive tasks, reduces manual errors, speeds up reporting
Hardware & IoT Sensors	Smart meters, IoT devices, cloud servers, data storage	₹2-15 lakh / \$2,500-20,000 (SME); ₹30-50 lakh / \$35,000-60,000 (large scale)	Enables real-time monitoring of emissions, energy, water, and waste
Implementation & Integration	System customization, data migration, ERP integration	₹3-10 lakh / \$4,000-13,000 (SME); ₹20-40 lakh / \$25,000-50,000 (large scale)	Ensures seamless operation with existing systems; enhances accuracy and compliance
Training & Skill Development	Staff training, hiring specialists	₹1-5 lakh / \$1,300-6,500	Builds internal capacity; reduces errors; ensures efficient use of automation tools
Maintenance & Support	Software updates, hardware servicing, vendor contracts	₹1-3 lakh / \$1,300-4,000 annually	Keeps systems running efficiently; reduces downtime
Data Security & Compliance	Cyber security measures, regulatory compliance	₹1-4 lakh / \$1,500-5,000	Protects sensitive data; ensures ESG and audit compliance
Change Management	Process redesign, workflow adjustments	₹1-3 lakh / \$1,500-4,000	Smooth adoption of automated systems; enhances productivity

Estimated Total Investment:

- Small-Medium Scale Implementation: ₹13-50 lakh / \$16,000-65,000
- Large Enterprise Implementation: ₹1-1.5 crore / \$120,000-180,000

3.5 Green Accounting and Sustainability Initiatives in India

The Indian government has introduced several policies, incentives, and frameworks to encourage companies to adopt environmentally sustainable practices, including automated green accounting systems:

Table 3: Green Accounting and Sustainability Initiatives in India

Category	Initiative / Policy	Key Details / Support
Regulatory Support	Companies Act, 2013 (Section 135)	Requires CSR spending on environmental initiatives; promotes sustainability reporting and accounting tools
	SEBI ESG Disclosure Regulations	Top 1,000 listed companies must disclose ESG/environmental data; automation helps manage compliance
	Energy Conservation Act, 2001	Mandates energy audits and reporting; IoT and automation simplify compliance
	National Green Tribunal (NGT) Guidelines	Enforces strict environmental compliance; incentivizes accurate and automated monitoring
Financial Incentives	Perform, Achieve, and Trade (PAT) Scheme	Rewards industries reducing energy consumption; automated monitoring aids compliance and trading of excess energy credits
	Renewable Energy Certificates (RECs)	Companies can track renewable energy usage and claim certificates through automated systems
	Subsidies and Tax Benefits	State-level programs provide financial assistance for energy efficiency, waste management, and sustainability tools
Capacity Building & Technical Support	Bureau of Energy Efficiency (BEE)	Offers guidance, training, and tools for energy audits and environmental reporting
	Ministry of Environment, Forest & Climate Change (MoEFCC)	Provides frameworks, guidelines, and workshops to support environmental accounting
	State-level Initiatives	Programs in states like Maharashtra & Karnataka promote digital sustainability reporting and energy-efficient technologies
Encouragement of Technology Adoption	Government Policies	Emphasize IoT, AI, RPA, and block chain for environmental management; support smart energy management and automated reporting
	Public-Private Partnerships / Pilot Programs	Encourage adoption of real-time emission tracking and automated reporting systems

4. CONCLUSION

Automated green accounting represents a paradigm shift in how organizations measure and manage environmental performance. By integrating RPA, AI, IoT, cloud platforms, and block chain, companies can achieve real-time monitoring, predictive insights, and transparent reporting. Indian companies, aligned with government norms and global ESG frameworks, are increasingly adopting these technologies to improve operational efficiency, reduce environmental impact, and strengthen corporate responsibility. Future developments will make green accounting even more strategic, enabling data-driven, sustainable decision-making while promoting environmental stewardship globally.

REFERENCES

- CDP Global Environmental Report (2023), *CDP, Global Environmental Disclosure Report, 2023*, CDP Worldwide.
- Deloitte (2022), *Technology-Enabled Sustainability Reporting and ESG Transformation*, Deloitte Insights.
- Global Reporting Initiative (2023), *GRI Sustainability Reporting Standards and Digital ESG Disclosure Practices*.

- OECD (2023), *Blockchain Technologies for Environmental and Carbon Accounting*, Organisation for Economic Co-operation and Development Publishing.
- PwC Sustainability Insights (2023), *AI and Digital Transformation in ESG Reporting*, PricewaterhouseCoopers.
- UNEP (2023), *Annual Report, 2023*, United Nations Environment Programme.
- World Bank (2022), *Digital Technologies for Environmental Monitoring and Sustainable Development*, World Bank Publications.