MEST Journal

DIAGNOSING THE MANAGEMENT OF DIGITAL CIRCULAR ECONOMY FOR SUSTAINABLE INNOVATION IN ALGERIA

Abdelwaheb Sakhri
Badji Mokhtar University, Faculty of Economic, Commercial and Management Sciences, Annaba, Algeria
https://orcid.org/0009-0001-3387-1887

ARTICLE INFO

Open access

JEL Category:
M14, O33, Q55

Keywords:

digital technology, circular economy, sustainable innovation, Algeria.

ABSTRACT

This research paper aimed to explore the revolution the world has witnessed in integrating digital technologies into circular economy models and their positive impact on promoting sustainable innovation, particularly in light of the Algerian government's efforts to expand the use of digital solutions in institutions, protect the environment, and achieve sustainable development. The study employed descriptive and analytical methodologies, utilizing data and statistics obtained from official websites and reports. Among its key findings, the study concluded that the transition to a circular economy cannot achieve tangible economic efficiency without relying on digital tools (such as the Internet of Things and artificial intelligence). Furthermore, the studied global models demonstrated that adopting digital circular solutions provides institutions with resilience against raw material price fluctuations and opens new international markets, which is essential for Algerian institutions to diversify their non-hydrocarbon exports. Finally, the study emphasized the need for the Ministry of Startups to direct its support towards projects that innovate technological solutions (platforms, smart recycling applications) to serve national strategies.

1 INTRODUCTION

Given the challenges facing the world regarding resource conservation and health security, all evidence indicates that the circular economy is the cornerstone of sustainable development and achieving its goals, through its practices in recycling, manufacturing, clean energy, and extending product lifespan.

At the same time, in the era of technological advancement, the Fourth Industrial Revolution, driven by digital technologies such as big data, artificial intelligence, the Internet of Things, and cloud computing, is reshaping the relationship between digital transformation and sustainable innovation, especially considering growing environmental concerns.

Address of the corresponding author:
Abdelwaheb Sakhri
sakhriabdelwahab95@gmail.com

Received: 01.04.2026
Revised: 30.04.2026
Accepted: 14.05.2026
Available online: 15.05.2026

The theoretical foundations and practical experiments that combined digital innovation with transformations in the circular economy proved that it was not a mere coincidence. Digital solutions have enhanced the vital role of environmental governance in managing pollution levels and improved companies' ability to manage the environment. Therefore, digital data can significantly improve the efficiency of storage, sales, and delivery of economic activities across various industries, equipment, products, and services. Experts and specialists reported that the circular economy currently needs more innovation and new skills, and this can only be achieved by integrating digital technology into it.

In response to increasing global pressure for sustainable innovation, Algeria has developed several comprehensive and integrated plans aligned with the Sustainable Development Goals and has accelerated the adoption of digital technologies. This could very well yield benefits, especially since the circular economy is still in its early stages, with limited economic, environmental, and social awareness of its importance.

1.1 Research problem

Algeria has recently adopted an ambitious vision to accelerate digital transformation and support the circular economy as a strategic option for achieving sustainable development outside the hydrocarbon sector. However, the reality on the ground has revealed a regulatory and technical gap that has hindered the emergence of genuine sustainable innovation capable of translating government plans into tangible economic and environmental results. Based on the above, the following research question arises:

RQ: *What are the most significant challenges between digital transformation and the realities of circular economy practices in Algeria to achieve sustainable innovation?*

1.2 Objective of the study

This research paper seeks to identify the progress the world has made in the field of the circular digital economy and to examine relevant theoretical literature, applying it to the reality of Algeria to develop solutions and proposals to bridge the gaps.

1.3 Methodology and approaches

The descriptive approach was used to accurately describe the phenomenon under study by collecting recent references related to the circular digital economy and sustainable innovation, even regarding the lived reality in Algeria.

As for the analytical approach, work was done to assess the global situation of the circular digital economy and interpret the case studies of selected companies. The data were obtained from reliable and approved reports and official websites.

The research design was divided into three sections:

- Literature Review
- Digital Circular Economy Revolution Globally
- Diagnosing the reality of the circular digital economy in Algeria

2 LITERATURE REVIEW

The term "circular economy" has gained increasing popularity among governments, international organizations, regulatory bodies, academics, and researchers (Anwar, 2022); it represents a radical shift from the linear model as part of the modern economy, as circularity seeks to separate growth from resource consumption through the optimal exploitation of goods and products. But over time, despite the promises of circularity, flaws began to emerge, particularly a lack of data and knowledge to evaluate products and manage waste (UNECE, 2023).

Studies and research have confirmed that digitalization and technology play a crucial role in the circular economy transformation. Digital tools are powerful enablers for implementing the circular economy. However, this process requires a comprehensive approach that integrates various technological advancements and regulatory changes to effectively apply its principles and achieve sustainability. The digital economy utilizes data as a fundamental element and digital technology as a driving force to achieve deep integration between the digital and real economies (Afolabi, 2025).

2.1 Digital technology as the circular economy enabler

The intersection of digital transformation and the circular economy has generated significant momentum, evident in the impacts of Fourth Industrial Revolution technologies such as artificial intelligence, the Internet of Things, blockchain, and big data analytics, by restructuring models at both operational and strategic levels and moving towards more sustainable and efficient systems (Li et al., 2026).

Given the advantages offered by digital transformation and technology, the circular economy leverages the internet and big data technologies to reorganize production factor resources and improve traditional production processes. Artificial intelligence can significantly improve energy efficiency and reduce pollution emissions in the production process. The application of technologies such as smart monitoring, smart homes, telemedicine, and smart cities not only reduces energy consumption by the population but also improves social well-being (Zheng et al., 2025). The Internet of Things (IoT) enables companies to remotely monitor product usage, status, and location in real time, and to recycle scrap products, contributing to the transition to a circular economy. By leveraging the results of process analytics and big data processing in the digital economy, digital data can significantly improve the efficiency of storage, sales, and delivery across various industries, technologies, equipment, products, and services (Liu et al., 2021). Data analytics is a powerful approach to improving decision-making. Leveraging software and business intelligence systems, analytics enables companies to transform data into insights, providing a foundation for better decisions. This contributes to driving management towards a circular economy by providing the necessary information for sustainability-focused decision-making processes (Benkarouba & Benbouzian, 2022). 3D printing as a potential tool for repair and remanufacturing. As a real-time physical twin simulation infrastructure, powered by industry data, digital twinning enables the filling of a digital health card for products. Self-operating or collaborative robots are also used to train production workshop workers on operations and to provide advice and information about their work or the product (Perry et al., 2024).

The application of modern technologies is considered a promising way to overcome obstacles to the transition to a circular economy. It can provide opportunities for the manufacturing sector, such as upgrading equipment, increasing worker efficiency and motivation, building smart factories based on resource efficiency, and designing closed-loop manufacturing chains (Liu et al., 2022).

Digitalization and technology also work to remove many of the obstacles facing the circular economy, including: financial obstacles (measuring financial benefits, profitability); structural obstacles (lack of information exchange, lack of clarity in the distribution of responsibilities); operational obstacles (infrastructure, supply chain management); and behavioral obstacles (the concept of sustainability, avoiding risks) (Benkarouba & Benbouzian, 2022).

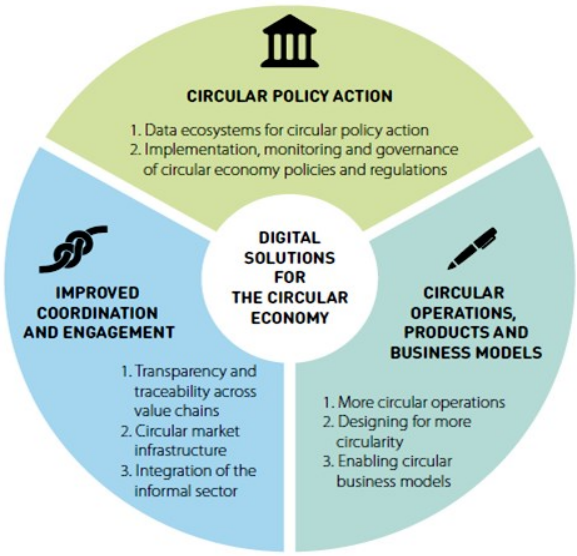

Figure 1. *Opportunities of Digitalization for Scaling up the Circular Economy*
Source: Compiled by Author

2.2 Technology and sustainable innovation

According to the United Nations Environment Program, digital technologies such as cloud computing, high-speed internet, and extended reality can help achieve the 17 Sustainable Development Goals (Florek-Paszkowska &

Ujwary-Gil, 2025). Despite the relatively recent convergence between digitization and sustainability trends, this phenomenon is gaining significant momentum as all parties call for the more sustainable and socially oriented use of digital technologies. Among the innovative sustainable outcomes, technology leads to energy efficiency, cleaner production, improved working conditions, and job creation. Adopting multiple digital technologies could enable companies to unleash sustainable innovation by leveraging the potential environmental and/or social benefits of each digital technology as sources of value creation (Ardito, 2023).

Cloud computing produces significantly fewer emissions than traditional server infrastructure. And, as with traditional software, when the Internet of Things is integrated with energy and utility systems, it supports smart grids that monitor energy consumption in real time, encouraging more sustainable use.(Mavi & Singh, 2025) Artificial intelligence and predictive analytics support preventative maintenance, helping various sectors use fewer resources, reduce costs, and increase efficiency. Smart homes also benefit from AI, which helps control heating, cooling, and lighting (Gülmez & Denktaş-Şakar, 2025). Many researchers have concluded that information and communication technologies play a crucial role in promoting sustainability, improving transparency, and enhancing evaluation capabilities through big data analysis and management. They also encourage high levels of development and entrepreneurial trends. (De Pascale et al., 2024). Digital media and communication technologies have undergone a radical shift towards "reducing reliance on materials" in recent years. This has made innovation more accessible and reduced the use of materials in manufacturing and recycling processes (OECD, 2024).

3 DIGITAL CIRCULAR ECONOMY REVOLUTION

Although the circular economy is a modern concept that focuses on strategies and solutions to improve how materials are used and achieve social welfare and ecosystem services that form the basis of an efficient economy, between 2018 and 2021, the Circularity Index was 6.9%, while the remaining Circularity Gap was 93.1%. The data revealed alarming facts: despite progress in some areas, the negative impacts remain significant, raising the question of what tools and innovations can make the world more sustainable (Rakowski et al., 2026).

In 2025, the UN Environment Program worked in 151 countries, advising governments and supporting businesses to become more sustainable in the face of the climate crisis related to emissions, chemicals, waste, and pollution. 17 countries were enabled in the field of technology to confront climate change through a financial envelope of US$70 million, and a partnership was formed with 4 countries in digital technology to make energy sustainable. For example, small and medium-sized enterprises in Africa and Asia contribute 25% of pollution. In this context, an alliance of 200 companies, including 37 technology companies, was launched to ensure more sustainable artificial intelligence (United Nations Environment Programme, 2026). But from another perspective, although these stimulus measures are appreciated, they cannot be considered a sovereign investment capable of bridging the technological gap, as providing a permanent financial envelope requires new financing mechanisms or "tax exemptions".

Despite the lack of data on the direct returns of the circular economy and the substantial capital costs required for ecological transformation, market forces are beginning to shift towards digital circularity as a competitive imperative. This is evident in the anticipated surge in the size of this market, which is projected to increase fivefold to reach $12 billion by 2032. This growth is not merely digital expansion, but rather an economic response to the effectiveness of technologies like the Internet of Things (IoT) in reducing long-term operating costs, thus transforming green practices from an investment burden into an engine for producing high-value-added sustainable goods.

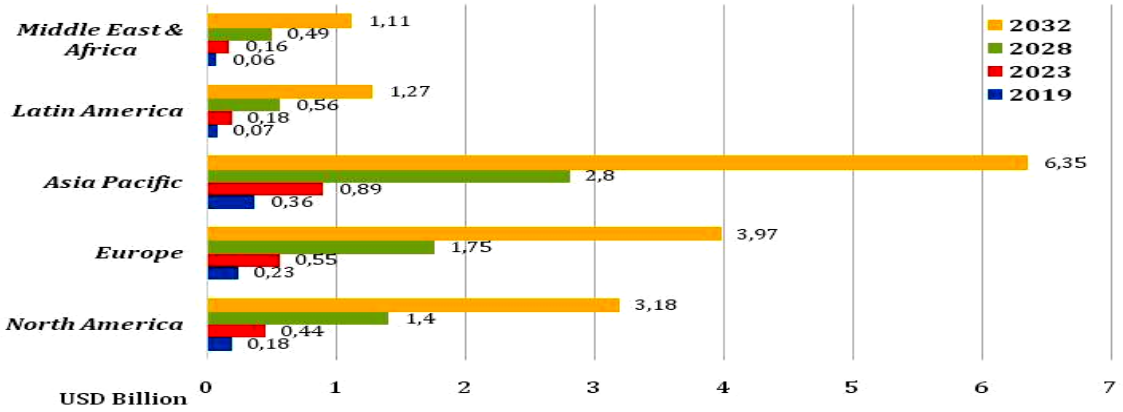

Figure 2. *Digital Circular Economy Market Size 2019-2032(USD Billion)*
Source: Author, based on (Agarwal, 2024)

According to a 2019 survey, approximately 28% of firms revealed that they had already integrated circular design methodologies into their innovation strategy. In contrast, around 39% stated that they intended to implement circular economy methodologies in their innovation strategy within the next two years. That's because many companies often announce green initiatives to improve their market reputation, but when it comes to implementation, they encounter high transition costs, also 12% of firms immediately decided to link the circular economy to the supply chain, This category is the most mature group, because a circular economy only succeeds if it includes supply.

A 2024 OECD survey found that 52% of respondents currently use smart devices, and 5% of them use the internet to reduce environmental impact. According to the International Energy Agency, demand for digital solutions will reach between 1.5% and 3% globally by 2026. The expansion in the use of artificial intelligence has contributed significantly to this growth and is expected to lead to a 160% increase in energy demand in data centers by 2030 (Gray & McSpedden-Brown, 2025).

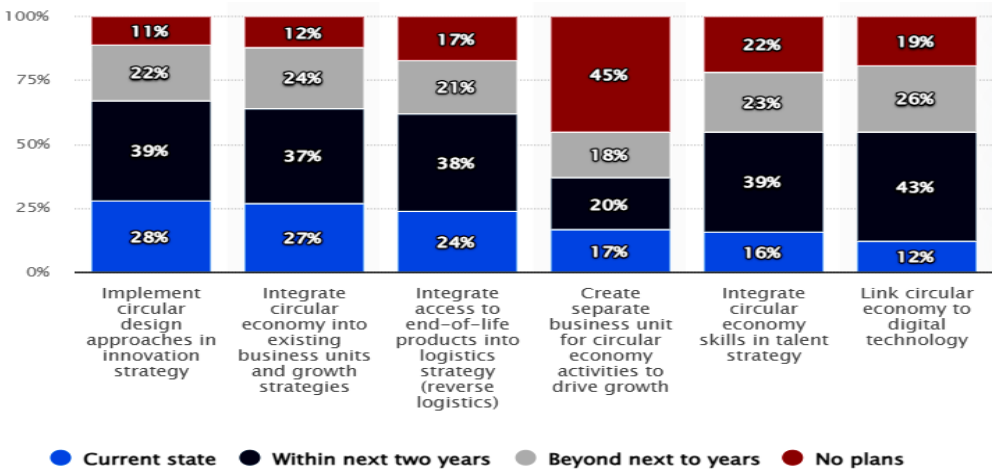

Figure 3. *Strategy of Supply Chain Firms to Integrate Circular Economy Practices*
Source: (Statista Research Department, 2025)

Due to the recent technological revolution, many companies and enterprises have transformed their linear business models into a circular format and considering the effects of human activities (such as climate change, pandemics, and resource scarcity), the strategic orientation and operational procedures of production companies are a clear contribution to sustainability.

Therefore, it will maintain and enhance its competitiveness while minimizing the negative environmental impact of commercial and production activities and manufacturing products with high efficiency. However, it is essential to always focus on building a mature digitalization model and expanding it to include sustainability considerations. This will provide more options in

strategy development processes that integrate sustainability in terms of social, economic, and environmental aspects (Kohl et al., 2023).

Table 1 illustrates the most prominent achievements of major related companies.

Table 1. *The 3 Largest Companies Relying on the Digital Circular Economy*

BMW GROUP (GER)	UNILEVER (UK)	CATERPILLAR (USA)
* The BMW Group is currently undergoing the biggest transformation in its history, having developed a strategic plan that sets new standards for sustainability and competitiveness: lean production, green production, and digital transformation. * The company now uses more than 100 electronic applications including virtualization and digital twinning, to improve production quality, automate logistics processes, and reduce the burden on workers. The company is working to reduce Co2 by embracing technology, through the production of electric cars and fuels made from renewable raw materials.	* As part of Unilever's GAP 2030 strategy, the marketing department is leading a rapid and radical transformation to unlock greater creative potential. Technology is helping to expand creative ideas that strengthen brands and drive sales. * Within the framework of the circular digital economy, the company has a set of goals, the first of which is to reach net-zero emissions by 2030.Innovative smart refill stations were launched for users, eliminating the need for plastic, and a chemical recycling technology was developed using artificial intelligence and the value chain to convert traditional non-recyclable waste into usable food products.	* The company is one of the largest factories in the construction and mining sectors. * It is also a pioneer in adopting technologies in the recycling process, restoring products to their original state with 90% less energy, saving 90% of raw materials, and reducing greenhouse gas emissions using the Internet of Things and big data analytics. The company's competitive advantage lies in its constant pursuit of sustainable innovation, particularly for its workers. Caterpillar's advanced software and cloud computing enable engineers to complete tasks in a fraction of the time, and the ambition now is to leverage artificial intelligence to enhance its business outcomes.

Source: (BMW Group, 2026; Unilever , 2026; Caterpillar , 2026)

The case study of the three companies reveals that the point of similarity between them is the gradual transition from a product-selling model to a product lifecycle management model through digital tools such as cloud and artificial intelligence. Digitalization is also used as a competitive shield to reduce dependence on raw materials, energy and emissions to open up new environmentally conscious consumer markets. The three companies have also linked technology to reducing the burden on workers and innovating for them, which is an important dimension in the social economy to ensure the acceptance of digital transformation:

1. *BMW Group:* The Company uses digital twinning to reduce trial-and-error costs. By digitally simulating the factory and testing production lines without disrupting the actual plant, it improves asset return and reduces waste in fixed capital. It focuses on investing in renewable fuels alongside electricity and pursues a strategy of diversifying its technology portfolio to cope with fluctuating energy prices and lithium supply chains. This raises the quality of the final product, enhancing its competitive advantage in the luxury goods sector.
2. *Unilever:* It is trying to move from the traditional sales system to selling without packaging, as the latter represents a large part of the cost of the final product; by eliminating it, it can improve the profit margin or offer competitive prices while reducing the risks of future plastic taxes.
3. *Caterpillar:* Saving 90% of raw materials and energy further reduces the cost of goods sold. The company resells the same material several times after refurbishing it, which dramatically increases the cumulative return on a single raw material. It uses the Internet of Things and big data as a tool for predictive maintenance. This reduces the opportunity cost resulting from the downtime of heavy equipment in mines or construction sites. Also, focusing on reducing task time through cloud computing means accelerating the innovation cycle, which keeps the company

technologically ahead of less digital competitors.

4 ANALYSIS OF THE SITUATION OF ALGERIA

Digital applications in the circular economy have become highly sought after in the Middle East and North Africa region, particularly in Algeria, especially after the COVID-19 health crisis and its negative impact on the economies of these countries, as well as the current challenges in environmental protection and waste management.

Although the circular economy is well-established and documented in national laws and regulations in Algeria, its concept is still in its early stages among the public and companies, due to a lack of awareness and its limitation to waste management and renewable energy solutions (Hadjivasiliouet al., 2023).

4.1 C-economy local problems

Algeria is considered a developing country where adopting a circular economy represents a real challenge that requires overcoming obstacles. The obstacles that Algerian companies face can be summarized as follows:

- *Technical Constraints*: Equipment and software are crucial for achieving the goals of the circular economy and are specifically used for environmental protection. However, their absence or inadequate availability creates challenges regarding the lack of qualitative and quantitative information on waste management and recycling practices.
- *Social and Cultural Challenges:* As previously mentioned, many industrialists, professionals, and businesspeople are unfamiliar with the modern concept of the circular economy. The prevailing negative view of waste, lack of awareness, absence of initiatives, and insufficient coverage by media and educational institutions have all contributed to the weak adoption of the circular economy (Adel & Guendouz, 2023).
- *Financial and legal obstacles:* Despite efforts to adopt the principles of the circular economy, Algeria continues to suffer from a lack of financial resources, regulatory frameworks, and laws, which could lead to a lack of public safety and health (Toumi, 2024).
- *Economic and Financial Constraints:* Investment in modern waste treatment technology remains low, and funding for circular economy initiatives is limited (Boudia & Djamil, 2025).

4.2 Government efforts in adopting digitalization and innovation

Since the years of independence, Algeria has been undertaking many initiatives to reach the digital revolution, especially since the higher authorities stressed the need to generalize the use of information and communication technologies and raise the level of digitization in the belief in the issues of energy, food and water security, and many bodies were created such as the Ministry of Digitalization and Statistics and the High Authority for Digitalization.

In June 2023 the National Digital Transformation Strategy 2025-2030 was launched, which aims to create a favorable business environment for the digital market, attract investments in this field, and improve Algeria's global ranking in digital development, also stimulating national social and economic development by promoting innovation, productivity, access to information, education, and social and financial inclusion (High Commission for Digitalization, 2024).

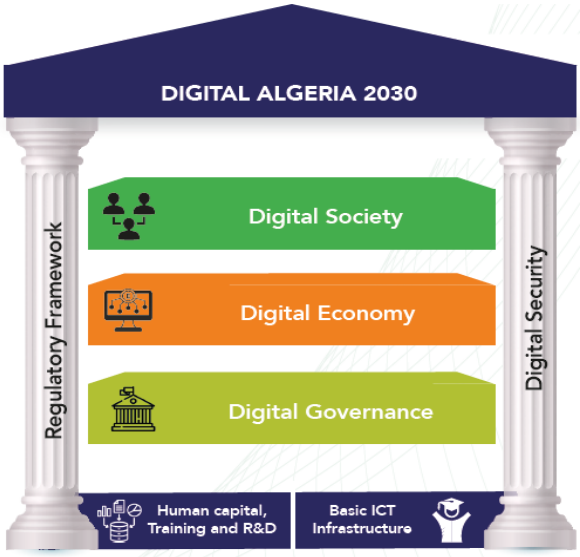

Figure 4. *The Algeria Digital 2030 Strategy*
Source: (High Commission for Digitalization, 2024)

To support innovation, the Algerian government has developed the National Innovation System Vision 2030-2040-2050. The first phase focused

on policy coherence and human capital development, given the weakness in scientific research and the lack of policy coordination. The second phase witnessed foundational work through creating integration between institutions, sectors, and regions, and promoting government innovation. The final step aimed for Algeria to become a global producer of knowledge, rather than just a user, and to distinguish itself with advanced innovations and competitive capabilities coupled with institutional maturity *(Zidane, 2025)*.

The Algerian strategies demonstrate a remarkable economic ambition to transition from a resource-based economy to a knowledge-based economy. However, they also present significant structural challenges. On the strengths side, Algeria has successfully established a specialized institutional framework and developed a long-term vision that transcends temporary solutions. This fosters investor confidence in the technology sector and startups and promotes financial and social inclusion. Furthermore, it reflects an awareness of the need to direct technology towards serving vital productive sectors, not just consumer ones. On the weaknesses side, the long timeframe of these strategies may clash with the accelerating pace of global technological advancements, potentially causing some objectives to fall behind schedule. Additionally, a potential gap exists between strategic texts and bureaucratic realities, which could hinder the agility of innovation. The transition from a consumer of knowledge to a global producer requires substantial investments in research and development (R&D) that exceed traditional financial capabilities. It also necessitates a more proactive legislative environment to transform academic human capital into tangible market-based economic value.

Table 2. *Cost-Benefit of Digital Technology Tools*

Technology	Cost (1000 USD)	Productivity Gain%
Cloud ERP	50-150	25-35%
IoT Sensors	20-80	15-25%
AI Analytics	100-300	30-45%
Automation	200-500	40-60%
Digital Training	10-30	10-20%

Source:(Zidane, 2025)

The purpose behind intensifying efforts and programs is to enable digital technologies to play a significant role in reducing the depletion of natural resources. This allows companies in Algeria to easily transition towards cleaner and more efficient production. Table 2 illustrates that investment in digital systems such as IoT sensors and artificial intelligence analytics enables the monitoring of energy flows and water, this a crucial step in diversifying Algeria's sources of income away from oil and natural gas revenues.

4.3 Programs to promote the circular economy

The following series of national and sectoral strategies have been developed to address a range of issues that hinder the operation of the circular economy in Algeria, and these are mainly as follows:

- *The National Integrated Waste Management Strategy for 2035* is a project of the Ministry of Environment and Renewable Energies, co-financed by the European Union, which will enable Algeria to develop better integrated waste management to contribute to the development of a green and circular economy and reduce environmental pollution.
  The main objective of this strategy is to reduce and recover value from the waste produced in Algeria. Algerian cities will have a more efficient and effective waste collection and treatment system. Selective waste sorting—by separating organic waste, paper and cardboard, glass, and other materials – will allow the government and the private sector to recover value from these materials and convert them into raw materials (Ministry of the Environment and Quality of Life, 2022).
- *Sustainable Consumption and Production National Action Plan (SCP-NAP*) established by the Ministry of Environment and Renewable Energy within the framework of the EU-funded SwitchMed program, with advisory services and technical support from the United Nations Environment Programme (UNEP)enables Algeria to renew its commitments to achieving the 17 Sustainable Development Goals (SDGs) more specifically Goal 12, and emphasizes the need to utilize digital solutions in this regard (The United Nations Environment Programme, 2020).
- *The Green Digital Innovation Plan 2025-2030* aims to develop and implement national

strategies for transitioning to renewable energy, promoting sustainable agricultural practices, and advancing low-carbon industrial development. It seeks to mitigate the effects of climate change, ensure energy security, and achieve economic diversification simultaneously*(Mahachi, 2025)*.

- *The Algerian National Blue Economy Strategy 2030 (NBES)* focusing on maritime and coastal areas, aims to drive and promote sustainable economic development throughout Algeria, with particular attention to supporting and developing employment opportunities and creating value across all value chains of the national economy (Economie Blue, 2022).

These Algerian national strategies represent a structural ambition and a qualitative leap aimed at digitizing vital sectors and valuing waste as an alternative raw material to reduce the import bill. The advantages are evident in the comprehensiveness of the vision that links food, water, and energy security with digital innovation, giving Algeria a "roadmap" that is compatible with international standards and attractive to foreign investments, especially through partnerships with the European Union and the United Nations Environment Program. However, gaps stand out in the heavy reliance on external financing and government support, which raises questions about the sustainability of these projects without direct investments from the local private sector. They also suffer from conflict between major strategic objectives and the bureaucratic and technical reality.

5 CONCLUSIONS

This article discusses the role of the digital economy as a key driver of sustainable innovation and the promotion of circular economy principles, and its application to the Algerian context.

The findings highlighted that digital technology, including automation, artificial intelligence, the Internet of Things, cloud computing, and data analytics, has the potential to contribute to environmental sustainability by reducing energy consumption, minimizing emissions, and promoting resource-efficient production processes.

The comparison between BMW, Unilever, and Caterpillar shows that digital technology is no longer just a tool for improving production but has become the main driver for restructuring the economic business model to ensure sustainability and profitability. The companies also share that “circular digitalization” has given them immunity against fluctuations in raw material prices and a greater ability to comply with strict environmental legislation, making them more attractive to investors looking for long-term and sustainable financial performance.

Algeria today possesses a range of visions. This integration proves the existence of a political will to break free from dependence on hydrocarbons by transforming environmental and digital challenges into investment opportunities to create added value. However, the problem remains the slow pace of transforming these strategies into an active "economic market" in which the private sector participates as a key player. Despite the focus on digitalization, the technological gap in data centers and artificial intelligence still constitutes an obstacle to the actual application of the smart circular economy, such as digital tracking of waste or predictive maintenance of industrial assets.

Some suggestions can be offered on the core of the subject: modernizing the legal and legislative framework by reviewing and updating laws related to waste management to adopt the principles of the circular economy, encouraging startups to innovate modern solutions and technologies for waste management and clean production, especially in the industrial sector; developing bank financing mechanisms for projects that adopt the green economy, allocating substantial capital to advanced recycling technologies, and raising environmental awareness.

Algerian companies must intensify their efforts in developing artificial intelligence algorithms specifically designed to improve logistics and manage waste sorting with precision, while promoting a culture of responsible consumption.

In conclusion, Algeria 2026 stands on the cusp of a new industrial revolution, its motto being intelligence in the service of sustainability. Furthermore, successfully integrating digitalization with circularity is not merely an economic project

but a national commitment towards future generations.

Regarding research limitations, there is a scarcity and difficulty in accessing accurate and up-to-date digital data on actual waste recycling rates in Algeria. This limited the analysis to the challenges and strategies adopted, making the study somewhat prospective, with the hope of future advancements.

Future research directions include the need to study mechanisms for implementing carbon taxes as a tool to incentivize Algerian industrial companies to adopt circular solutions, while also exploring the role of startups in developing local software for managing "reverse supply chains." It is also suggested to focus on analyzing "digital twinning" in the renewable energy and desert agriculture sectors to reduce material waste.

WORKS CITED

Adel, F. Z., & Guendouz, A. (2023). Circular economy in Algeria: Strategies and obstacles. In A. Mohammed El Amine & M. Shahbaz (Eds.), *Digital economy, energy and sustainability: Opportunities and challenges*. Springer Nature. https://www.springerprofessional.de/en/circular-economy-in-algeria-strategies-and-obstacles/24081496

Afolabi, J. A. (2025). Advancing the circular economy in Europe: The role of eco-innovation, economic complexity, and digitalization. *Technology in Society, 83*, 1–13. https://doi.org/10.1016/j.techsoc.2025.103027

Agarwal, A. (2024). *Digital circular economy market share, size, trends, industry analysis report by offering (software, services); by technology; by application; by vertical; by region; segment forecast, 2024–2032*. Polaris Market Research. https://www.polarismarketresearch.com/industry-analysis/digital-circular-economy-market

Anwar, O. (2022). *Towards a circular economy in the Arab region: Development of transformation measurement index*. Arab Monetary Fund. https://www.amf.org.ae/en/publications/economic-studies

Ardito, L. (2023). The influence of firm digitalization on sustainable innovation performance and the moderating role of corporate sustainability practices: An empirical investigation. *Business Strategy and the Environment, 32*, 5252–5272. https://doi.org/10.1002/bse.3415

Benkarouba, F. Z., & Benbouzian, M. (2022). The role of digital technologies from Industry 4.0 in implementing the circular economy and achieving sustainability. *Industrial Economics Review, 12*(2), 88–110. https://dspace.univ-batna.dz/items/6f4ccc50-afd9-4732-9c7f-2e2f7bdc2c83

BMW Group. (2026). *Digital technology, circular economy, sustainable innovation*. https://www.bmwgroup.com/en.html

Boudia, M., & Djamil, M. (2025). The circular economy and household and similar waste (HSW) management in Algeria: An overview. *Review MECAS, 21*(1), 166–180. https://asjp.cerist.dz/en/article/268143

Caterpillar. (2026). *Digital technology, circular economy, sustainable innovation*. https://www.caterpillar.com/en/news/caterpillarNews/2024/future-of-ai-at-caterpillar.html

De Pascale, G., Faccilongo, N., Riefolo, M., Romagno, A., & Silvestri, R. (2024). Digital innovation and sustainable development: Two sides of the same coin. In L. Aldieri (Ed.), *Innovation: Research and development for human, economic and institutional growth*. IntechOpen. https://doi.org/10.5772/intechopen.112294

Economie Blue. (2022). *National strategy for the blue economy – Algeria*. https://economiebleue.dz/wp-content/uploads/2022/09/2.-Strategie-Nationale-pour-l-Economie-Bleue-SNEB-2030-Resume_compressed.pdf

Florek-Paszkowska, A., & Ujwary-Gil, A. (2025). The digital-sustainability ecosystem: A conceptual framework for digital transformation and sustainable innovation. *Journal of Entrepreneurship, Management and Innovation, 21*(2), 116–137. https://doi.org/10.7341/20252127

Gray, H., & McSpedden-Brown, N. (2025). *Leveraging digital business models, tools and technologies for reliable environmental information and consumer engagement in the circular economy*. OECD Digital Economy Papers. https://www.oecd.org/en/publications

Gülmez, S., & Denktaş-Şakar, G. (2025). Digital transformation framework for logistics service providers: A systematic literature review. In B. M. Affan, G. Ruchika, S. Priyank, A. Imran, & A. C. Elizabeth (Eds.), *Handbook of digital innovation, transformation, and sustainable development in a post-pandemic era*. Taylor & Francis Group. https://doi.org/10.1201/9781003438748-4

Hadjivasiliou, F., Abdel Samad, O., & Tania, A. (2023). *The circular economy ecosystem in the MENA region. Covering Algeria, Egypt, Jordan, Lebanon, Morocco, Tunisia, Palestinian territories*. Deutsche Gesellschaft für Internationale Zusammenarbeit. https://www.giz.de/sites/default/files/media/pkb-document/2025-11/2023-giz-ce-mena.pdf

High Commission for Digitalization. (2024). *National strategy for digital transformation in Algeria: For a digital Algeria 2030*. https://www.hcn.dz/projets/juridique/SNTN

Kohl, H., Seliger, G., & Dietrich, F. (2023). *Manufacturing driving circular economy*. Proceedings of the 18th Global Conference on Sustainable Manufacturing, October 5-7, 2022, Berlin, Springer Nature.

Li, H., Zhijian, L., & Zhu, P. (2026). Digital platforms as enablers of circular economy practices: Insights from a Chinese province. *Technology in Society, 84*, 1–9. https://doi.org/10.1016/j.techsoc.2025.103075

Liu, Q., Trevisan, A. H., Yang, M., & Mascarenhas, J. (2022). A framework of digital technologies for the circular economy: Digital functions and mechanisms. *Business Strategy and the Environment, 31*, 2171–2192. https://doi.org/10.1002/bse.3015

Liu, Z., Liu, J., & Osmani, M. (2021). Integration of digital economy and circular economy: Current status and future directions. *Sustainability, 13*(7217), 1–27. https://doi.org/10.3390/su13137217

Mahachi, N. (2025). Strategic integration of green innovation in Algeria: Pathways to sustainable economic transformation. *El-Tawassol Journal, 31*(3), 14–26. https://asjp.cerist.dz/en/article/276269

Mavi, A. K., & Singh, T. (2025). *Sustainable innovation in the digital economy*. Shubhangam Publication. https://shubhanga.co.in

Ministry of the Environment and Quality of Life. (2022). *Waste and recycling*. https://www.me.gov.dz/fr/dechets-et-recyclage/

OECD. (2024). *OECD digital economy outlook 2024: Strengthening connectivity, innovation and trust*. OECD Publishing. https://www.oecd.org/en/publications/oecd-digital-economy-outlook-2024-volume-2_3adf705b-en.html

Perry, N., Chavanne, R., Parthasarathi, S., Alix, T., Bauer, T., et al. (2024, June). *Circular economy 4.0 or the use of Industry 4.0 technologies to circularize complex products: SDC2 smart disassembly cell for circularity.* Paper presented at the 1st Interdisciplinary Congress on Circular Economy, Montpellier, France. Available at HAL: https://hal.science/hal-04573976

Rakowski, D., Ewalts, D., & Acqua, C. D. (2026). *Global circularity gap report 2026*. Deloitte. https://www.deloitte.com/global/en/issues/climate/global-circularity-gap.html

Statista Research Department. (2025, November 29). Supply chain approaches to the circular economy worldwide 2019. Statista. https://www.statista.com/statistics/1182874/circular-economy-supply-chain-approach/

United Nations Environment Program. (2020, February 3). *Sustainable consumption and production national action plan*. https://www.unep.org/resources/report/sustainable-consumption-and-production-national-action-plan

Toumi, C. (2024). The circular economy: Algeria towards a new approach. *Economic Studies Journal, 18*(1), 97–107. https://asjp.cerist.dz/en/article/243288

United Nations Economic Commission for Europe. (2023). *Accelerating the transition towards a circular economy in the UNECE region: Leveraging digital solutions for the circular economy*. https://unece.org/trade/CicularEconomy/UNDAProject

Unilever. (2026). *Digital technology, circular economy, sustainable innovation*. https://www.unilever.com/sustainability/plastics/

United Nations Environment Programme. (2026, October 2). *Annual report 2025*. https://www.unep.org/resources/annual-report-2025

Zheng, J., Guo, M., & Lo, K. (2025). Shaping sustainability: Circular economy development through digital technology innovation. *Journal of Innovation & Knowledge, 10*, 1–14. https://doi.org/10.1016/j.jik.2025.100784

Zidane, Y. J.-T. (2025). Algeria's Vision 2030–2040–2050: Building Algeria's national innovation system (ANIS) for sustainable development. In *Algeria's economic policy towards 2030 – Vision 2030* (pp. 1–19). University of Algiers 3. https://doi.org/10.13140/RG.2.2.24119.38567/1