JEL Classification: L26, M13, M14

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ECO-INNOVATION AND CORPORATE SOCIAL RESPONSIBILITY IN ALGERIAN ENVIRONMENTAL STARTUPS

Received 09 August 2024; accepted 21 August 2024; published 13 September 2024

Abstract. *This study examines the impact of ecological innovations on the emergence of corporate social responsibility (CSR) practices within Algerian environmental startups. The study uses a qualitative methodology based on interviews with startup founders. It highlights how these innovations foster the adoption of CSR practices. The results show that ecological innovations are crucial to startups' social transformation, making them more environmentally sustainable and socially engaged. The challenges and opportunities related to integrating ecological innovation into CSR practices are also discussed, emphasising the need for institutional support to encourage these initiatives. The study contributes to the literature on environmental startups in Algeria, an underexplored field strategically crucial for sustainable development.*

Keywords: *eco-innovation, environmental startups, corporate social responsibility, socially responsible behaviour.*

Citation: Nassima Ghezali; Houria Sekkal. (2024). ECO-INNOVATION AND CORPORATE SOCIAL RESPONSIBILITY IN ALGERIAN ENVIRONMENTAL STARTUPS. Economics and Finance, Volume 12, Issue 3, 65-75. http://doi.org/10.51586/2754-6209.2024.12.3.65.75

Introduction

In the early 1950s, the first writings on the harmful consequences of industrialisation on society were published. Bowen (1953) was the first to question the relationship between the functioning of an economic system and social well-being in his book “Social responsibilities of the businessman”. The climate emergency and global environmental awareness have recently imposed a rethinking of the traditional business model, placing ecological innovation at the heart of corporate development strategies, particularly in the startup sector. States are obliged to redirect their governmental policies to address ecological degradation and social disparities. This new vision aligns with a broader objective aimed at overall performance. In Algeria, recent governmental policies encourage investment in innovative projects. The latest measures explicitly support young startup project leaders through mechanisms and structures of support and funding, such as incubators, accelerators, the Algerian startup fund (ASF), and others. These young companies, often characterised by their agility and capacity to innovate, play a crucial role in transforming the economic landscape towards more sustainable practices by venturing into innovative fields such as renewable energy, electric mobility, sustainable agriculture, waste management, and sustainable construction.

Theoretically, a socially responsible company is committed to integrating social, environmental, and economic issues into its strategy and operations. At the same time, eco-innovation aims to contribute to environmental sustainability and economic viability. The juxtaposition of these two concepts leads us to reflect on the link between “eco-innovation” and the adoption of socially responsible behaviour within an eco-innovative startup. It is worth noting that more studies are needed to explore the direct impact of these ecological innovations on CSR

practices within Algerian startups. Although CSR has been extensively studied, more research needs to be conducted on the involvement of startups in CSR (Keskitalo, 2023). Startups actively integrating ecological innovations are more likely to adopt robust CSR practices, suggesting that ecological innovation can serve as a lever for a sustainable corporate culture. Thus, this research aims to analyse the impact of ecological innovation on the emergence of CSR practices within startups engaged in this path.

By adopting a detailed qualitative analysis of this dynamic, this article explores the existence of a link between environmental innovation and the emergence of socially responsible behaviour within the startups selected for our study. This research significantly contributes to the literature on ecological startups in Algeria, a context hitherto underexplored but strategically important.

The article's structure unfolds as follows: first, we present a literature review covering theoretical foundations and previous studies, the results obtained, a discussion of practical implications, and finally, a conclusion.

Literature Review

From Schumpeterian Innovation to Eco-Innovation:

Before defining eco-innovation, it is imperative to understand innovation in its general sense. Unlike eco-innovation, the concept of innovation essentially dates back to Schumpeter, one of the first theorists to define it, which he believed would have a positive impact on societies.

In his book Business Cycles (1939), he explains that companies face cycles of innovation that generate “creative destruction”, allowing for economic growth over time. Schumpeter (1934) categorises innovation into five distinct types: the implementation of novel products, the adoption of innovative production methods, the exploration of untapped markets, the discovery of fresh sources for raw materials or other inputs, and the establishment of new market frameworks within an industry.

There are different definitions of innovation. According to the OECD, “Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations” (OECD, 1994). According to the Oslo Manual (1994), for it to be considered an innovation, the company's product, process, marketing strategy, organizational structure, or external relations must be new (or significantly improved).

Innovation is vital for companies as it represents an engine of economic growth, which is seen as the primary goal of most countries and is universally recognized as essential for the health of national economies. However, it cannot guarantee the general well-being of the population alone. Even more importantly, it can sometimes threaten the environment, causing climate change, biodiversity loss, water and air contamination, and desertification.

In 1972, the Club of Rome report, titled “The Limits to Growth” was the first study to highlight through its “Meadows Report” the negative externalities of economic activity and demographic growth on the environment (the first time a scientific study calculated the limits of growth on Earth). The report stipulated that “if current trends in world population growth, industrialization, pollution, food production, and natural resource depletion continue unchanged, the limits to growth on this planet will be reached within the next 100 years” (Berger et al., 2014).

The shift towards a sustainable economy has become a significant challenge for companies under the dual pressure of crisis and environmental constraints. Considering the ecological and environmental aspects is imperative, hence the genesis of eco-innovation or environmental innovation in the 1980s. Eco-innovation (also known as environmental innovation or green innovation) emphasizes how innovation affects the environment, adopting new technologies, processes, or products to reduce environmental impact while promoting sustainability. “Green innovation is the introduction of a new or significantly improved product (good or service), process, organizational method, or marketing method that generates an environmental benefit compared to existing alternatives” (Gicquaud, 2010, cited in Kafi & Elbayed 2021). It “reduces the impact of

general or particular activity on the environment" (Boutillier et al., 2012, cited in Kafi & Elbayed, 2021).

According to the European Commission's Eco-Innovation Observatory, "Eco-innovation is the introduction of any new or significantly improved product (good or service), process, organizational change, or marketing solution that reduces resource use (including materials, energy, water, and soil) and decreases the ecological footprint throughout the life cycle" (EIO_Methodological_Report_2010.pdf).

Conferring to Runnings (2000), as cited by Kainrath (2009), eco-innovation refers to the actions taken by various actors such as companies, politicians, unions, associations, churches, and private households to create, introduce, or implement new methods, products, behaviours, and ideas that help reduce environmental impacts or achieve specific ecological sustainability objectives. This type of innovation is characterised by its dual external impact, regulatory effect, and the growing significance of social and institutional innovation.

Galliano and Nadel (2018) remind us that environmental innovation was introduced into innovation economics (mainly evolutionary) in the early 2000s and that it is distinguished from classical innovation by the complementarity it can have with other forms of innovation.

The creation of double externalities, or a positive external impact on the environment and the knowledge flows produced by any innovation, distinguishes environmental innovation. The OECD (2009), in its definition, goes beyond previous theoretical definitions. According to this organization, there are two ways to differentiate ecological innovation from traditional innovation. First, it is not an evolutionary concept because it represents an innovation that emphasizes reducing environmental impacts, and second, ecological innovation is not limited to the creation of products, processes, or marketing or organisational methods but also involves changes in social and institutional structures.

From Economic Startup to Ecological Startup:

Before explaining the term eco-innovative startup, it is important to define the startup and highlight its peculiarities. According to Steve Blank, one of the Silicon Valley pioneers, "A startup is a temporary organization designed to search for a repeatable and scalable business model" (Blank & Dorf, 2019). This definition highlights the main characteristics and specificities, which are:

• Temporality: Being a startup is not an end; it is a phase of startup development, with the main objective of evolving towards an industrializable business model.

• The search for a business model: A nascent company strives to provide consumers with a unique product or service, aiming to offer something unique in the market. The main challenge for this startup is to design and implement a business model that stands out from already established traditional structures.

• The possibility of industrialisation: A newly created company seeks a model that can be developed on a larger scale in other locations or created by others.

• Scalability: This implies that an increase in the number of customers leads to an increase in profit margins. In this model, prices for subsequent customers gradually decrease after the initial rate is higher. This ability to scale, making the model easily replicable, allows startups to grow rapidly and distinctively compared to conventional companies.

The Emergence of a New Type of Startup, "The Environmental Startup":

According to a groundbreaking article in the Harvard Business Review from the early 1970s (Quinn, 1971 cited by Schaper, M. 2002), the "ecology movement" could open up lucrative new markets for business expansion rather than merely being a drag on economic activity. By the late 1980s, this theme was gaining traction. Elkington (1980) said that creative business solutions have the potential to enhance the environment and provide the groundwork for untapped commercial prospects that conventional corporations have overlooked. During the 1990s, there was an increasing emphasis on environmental entrepreneurship, which included a more thorough and specific examination. Early pioneers in the field of entrepreneurship, such as Blue (1990), Bennett

(1991), Berle (1991), and were instrumental in popularising terms like “environmental entrepreneur”, “eco-entrepreneur” and “ecopreneur”.

Chukwuka (2018) states that eco-entrepreneurs engage in sustainability-focused activities that include various initiatives aimed at minimising the environmental effects of their company operations and achieving cost savings. This implies that they will use a reduced amount of raw materials, natural resources, energy, and water, leading to a decrease in waste and decreased operational expenses for the enterprise.

Eco-entrepreneurship capitalises on the difficulties associated with climate change and sustainable development, providing prospects for inventive solutions to emerging problems. This new entrepreneurial trend offers a viable option that is both cost-effective and environmentally friendly. It is often supported by government regulations that provide incentives to promote its adoption. Promoting ecological entrepreneurship is widely acknowledged as a crucial component of all sustainable development programs. Entrepreneurship has the potential to foster the spread of innovative ideas that may enhance the global socio-economic and ecological conditions. Eco-startups are a novel kind of startup that prioritise environmental concerns while balancing both financial and non-financial goals. Recently, there has been a rise in the use of several terminology to describe companies that have aims beyond just making money, such as green startups, green-tech, clean-tech, eco-innovative startups, and responsible startups.

In our study we will focus on startups whose innovation is committed to having a positive impact on the environment, commonly called eco-innovative startups, green startups. The term eco-innovation has been used as a synonym for green innovation and environmental innovation, Kunapatarawong & Martínez-Ros (2016).

CSR practices within startups:

Corporate social responsibility (CSR) is a topic that generates considerable reflection, as its definition and implementation remain highly relative to the company's socio-economic, regulatory, and environmental context. “The term [social responsibility] is a brilliant one; it means something, but not always the same thing, to everybody” (Votaw, 1973, cited by Carroll, 1999).

Carroll (1999), in his article, listed over twenty definitions, all emphasizing the idea that the outcome refers to the obligations of companies that extend beyond purely economic, financial, technical, or legal dimensions – in other words, taking into account other aspects beyond the economic aspect and ensuring that the externalities of their activities have a positive effect on the environment and society. Operationally, CSR is the application of sustainable development principles within the company. The Brundtland Report's sustainable development concept has provided an approach method integrating three dimensions (economic, ecological, and social). These three pillars were translated by Elkington (1999) into the notion of “triple bottom line”, meaning that a company's performance should be assessed in the economic, social, and environmental domains. In recent years, companies have placed greater importance on corporate social responsibility. Stakeholders' needs have evolved with new generations, and the effects of climate change, among other things, have forced companies to adopt such practices.

Link between Eco-Innovation and CSR (Previous Work):

According to a bibliometric analysis conducted on the relationship between eco-innovation and corporate social responsibility, significant importance has been given to this topic. Between 2000 and 2022, 4,520 articles were published, with 1,539 articles published in 2022, leading the most involved countries in the topic: China, the United Kingdom, Spain, the United States, Malaysia, India, Pakistan, Australia, and Germany (Salazar-Soto & Pinzón-Castro, 2023).

Le Bas and Poussing (2010) state that innovations can positively impact companies' responsible engagement and various aspects of applied CSR. “The existence of a strong, statistically significant relationship between being an innovative company and adopting a CSR approach” (Le Bas & Poussing, 2010). Temri et al. (2015) found that product or process innovation, but not organizational innovation, positively influences the propensity to implement CSR strategies. Being a technological leader positively contributes to involvement in social responsibility initiatives.

Additionally, it has been shown that companies focused on innovation tend to integrate CSR in several aspects simultaneously. The synergy effect between these two practices can allow companies that engage in them to gain a competitive advantage. This dynamic is analysed from the perspective of technological innovation actively influencing the implementation of CSR.

Methods

For our research, we favoured a qualitative approach, a method increasingly asserting itself in management sciences. It constitutes a rich and diversified methodological corpus, facilitating the extraction of information, the identification of emerging trends, and the analysis of social dynamics that may escape quantitative approaches (Alami, Desjeux, & Garabuau-Moussaoui, 2009). Based on a series of semi-structured interviews with the founders of ten ecologically engaged Algerian startups, the research aims to capture experiences, motivations, key ecological innovations and their impact, challenges, and opportunities related to the ecosystem, the perception of CSR by the founders, and their involvement in socially responsible practices. This approach allows an in-depth exploration of the complex nuances and underlying dimensions shaping ecological innovation and CSR practices in these nascent companies.

The participants in this study were carefully selected from a wide range of ecological startups operating across Algeria. The geographic diversity of the startups was an essential criterion, allowing a broad spectrum of experiences and environmental and economic contexts to be covered. Due to the geographical dispersion of the selected startups across Algeria's vast territory and to facilitate access to entrepreneurs while respecting time constraints, some interviews were conducted online, which also allowed for the creation of a comfortable environment for participants, thereby fostering openness and richness in exchanges.

The duration of the interviews varied considerably, ranging from one and a half hours to three hours, reflecting the depth and richness of the discussions. This flexibility allowed us to adapt to the rhythm of each entrepreneur, developing a deep understanding of their background and ecological innovation practices. The interviews were recorded with participants' consent and fully transcribed for later analysis. A thematic analysis was employed using Nvivo12 software to identify, analyse, and report patterns (or themes) in the data. This method significantly structured participants' responses around the study's central themes, particularly the impact of environmental innovation on the emergence of CSR practices within Algerian ecological startups.

Results

Presentation of interviewed startups:

Our surveyed population consists of ten Algerian environmental startups active in recycling, eco-construction, renewable energies, environmental protection, and water resource preservation. The table below highlights the fields of activity and main innovations of the interviewed startups, as well as the profiles of the founders. The companies are numbered from 1 to 10 to preserve the anonymity requested by the startup founders (Table 1).

Presentation of survey results:

Background and motivations of founders: The founders of the studied startups have diverse academic and professional backgrounds, which influence their motivations and approaches to ecological innovation. For Startup 8, the family team members are trained in architecture, agronomy, and mechanical engineering, with international experience. Their studies abroad allowed them to acquire the knowledge they wished to apply in Algeria. "*We all have higher education, and some of us studied abroad before returning to Algeria to apply our knowledge*", explains one of the founders. Their primary motivation is to provide solutions to farmers to reduce post-harvest losses and improve food security in rural areas. Regarding waste valorisation, most of the interviewed startups were created by entrepreneurs passionate about nature and recycling who voluntarily participated in environmental protection cleanup campaigns from a young age. For example, Startup 1 was founded by an entrepreneur passionate about the circular economy.

With a solid background in social entrepreneurship and professional experience in various sectors, the founder of this startup aims to structure and organize the plastic waste recycling value chain. *"The goal is to improve the circularity of plastic waste by structuring and organizing the recycling value chain"*, he specifies.

Table 1. Presentation of interviewed startups

Startup	Field of activity	Key of innovation	Founder's education	Gender	Location
1	Recycling	Digital solutions in circular economy connecting chain actors to a sustainable ecosystem based on the circular economy	Master in Social Entrepreneurship	Male	Wilaya of Blida
2	Recycling	Recycling and valorization of plastic waste	PhD candidate in management	Male	Wilaya of Oran
3	Recycling	Platform designed to facilitate community participation in cleaning campaigns and waste management	PhD in management	Female	Wilaya of Tlemcen
4	Recycling	Recycling dairy factory waste or date waste to provide raw materials to certain sectors	PhD in pharmacy	Male	Wilaya of Algiers
5	Eco-construction	Production of ecological tiles and vertical gardens using crop residues	PhD in agricultural sciences	Female	Wilaya of Biskra
6	Eco-construction	Production of bricks from textile waste	PhD in electrochemistry	Female	Wilaya of Oran
7	Environmental protection	Forest fire detection and monitoring system using artificial intelligence	PhD in technological sciences	Male	Wilaya of Algiers
8	Renewable Energy	Revolutionising refrigeration systems and making them sustainable with solar energy	1 Architect, 1 PhD in agronomy, 1 mechanical engineer	1 female, 2 males	Wilaya of Oran
9	Renewable Energy	Using organic waste as a renewable energy source	PhD in Waste Management	Female	Wilaya of Algiers
10	Water Resource Conservation	Smart faucet to reduce domestic consumption	Hydraulic Engineer	Male	Wilaya of Algiers

Source: Created by the authors.

For Startup 2, the founder, a PhD student in management, has varied experience in several industries, including food, agriculture, and waste management. His motivation is to create economic value from polluting waste while improving the living conditions of informal collectors. *"Our business model is sustainable and inclusive, integrating multiple partners to create economic value from polluting waste"*, he explains.

The results for startups operating in renewable energies and natural resource preservation reveal that despite their diverse profiles, their vision aligns with a logic of sustainability. According to the founder of Startup 8, *"There is a mix between ecology and sustainability, and when we talk about it, there is confusion"*.

Concerning startups active in the eco-construction sector, their primary motivation is to promote the construction sector in Algeria while using materials that are either recycled or initially intended for destruction. Startup 5 was founded by an entrepreneur who wishes to promote urban agriculture and eco-construction using local materials. She wants to valorise agricultural waste and promote sustainable urban gardening by creating vertical gardens made from date palm fibre. *"We want to promote sustainable urban gardening practices to improve urban quality of life"*, she emphasises.

Ecological innovations and their environmental and social Impact:

The data collected reveals how the interviewed ecological startups significantly contribute to environmental preservation through targeted innovations, such as the invention of a smart faucet to reduce domestic consumption or the creation of a forest fire detection and monitoring system using artificial intelligence (startups 7 and 10).

For startups active in the recycling and waste management sector, the interviews indicate a marked trend towards adopting technologies that encourage increased participation in recycling. For example, Startup 1 developed a recycling platform that connects actors in the recycling chain and rewards citizens for participating in selective sorting. This initiative improves recycling practices, reduces plastic pollution, and creates jobs in the recycling sector. *"Our platform encourages selective sorting and raises awareness about recycling issues"*, highlights the founder. Another startup in the same sector stands out by designing ergonomic recycling bins and implementing an optimized logistics platform. This innovation integrates informal collectors into the official waste management circuit, thus improving their living conditions and valorising plastic waste. *"We have successfully integrated informal collectors and improved their living conditions"*, states the founder.

Regarding innovations using ecological construction materials, discussions with sector actors have highlighted the innovative use of underutilized resources (textile waste, agricultural residues). The founder of Startup 5 explained that *"the use of agricultural waste transformed into construction materials not only reduces pollution but also supports the circular economy"*. These comments underline the importance of innovation in promoting environmentally friendly construction practices. This startup uses date palm fibres to create vertical gardens, thus reducing pollution and valorising agricultural waste. This innovation promotes urban agriculture and improves the quality of urban life. *"Our innovation valorises agricultural waste and improves urban quality of life"*, explains the founder.

Startups active in the renewable energy sector innovate by finding ecological alternatives to fossil fuels, such as using organic waste or solar energy as renewable energy sources. Startup 9's biodigesters allow individuals in isolated areas and farmers to produce their own less polluting and cheaper biogas from their waste, thus providing electrification solutions for isolated areas in Algeria.

Startup 8 developed a refrigeration system powered by solar energy, addressing the storage and transport problems of agricultural products in rural areas. This innovation helps reduce food losses, support farmers, promote the use of green energy, and open up rural areas. *"Our innovation reduces food losses and supports farmers in rural areas"*, explains one of the founders.

CSR perceived by founders:

The perception of CSR among the different interviewed startups reveals a diversity of understandings and approaches regarding this concept. For Startup 5, CSR is approached from a practical and operational perspective. The founder recognizes the importance of CSR practices such as respecting workers' rights, gender parity, and commitment to the United Nations' sustainable development goals. However, they seem to have a limited understanding of the concept itself. Despite this, they acknowledge the importance of meeting these criteria to obtain funding and gain legitimacy. For Startup 8, CSR is more integrated into their entrepreneurial DNA. They consider CSR not a mere obligation or separate approach but an intrinsic component of their project since its inception. They emphasize that their project considers economic, environmental, and social dimensions from the outset. The majority of startups approach CSR from the perspective of social impact. The founders emphasize their commitment to their partners, customers, and suppliers, ensuring that their activities have a positive social impact. They consider the social aspect a priority. Finally, for Startup 2, CSR is envisioned through a more concrete approach focused on specific actions aimed at improving the living conditions of waste collectors. Their CSR approach centres on creating economic value from polluting waste while contributing to the social well-being of collectors. *"We have successfully integrated informal collectors and improved their living conditions, demonstrating our commitment to a circular and socially responsible economy"*, affirms the founder.

Opportunities and Constraints:

According to the survey results, startups engaged in ecological initiatives often receive significant recognition on the international stage. As shared by the founder of Startup 5,

international competitions and events secure substantial funding and win prestigious awards that can transform an idea into an operational business. "*Participation in competitions such as the 'Green Product Awards' in Germany is exemplary, where innovative projects are validated and supported by an international community*", she asserts.

Building networks and establishing strategic partnerships with renowned entities through networking events are also crucial, highlights another startup founder. The founder of Startup 5 explained how such interactions led to collaborations with international organizations. "*These partnerships not only validate the innovation but also open pathways for commercial development and the application of sustainable solutions in various contexts*". According to most interviewed startups, government support is also a key catalyst for integrating circular economy practices into nascent companies. The founder of Startup 8 highlighted the impact of this support: "*Being coached by the Ministry of Environment integrated circular economy aspects into our process*". These ten entrepreneurs also claim to have benefited from tax advantages that alleviate financial burdens, thus supporting the growth and sustainability of these initiatives. As the founder of Startup 8 shared, "*Being recognized by a label is perceived as a mark of seriousness that facilitates access to significant resources and enriching experiences*".

Regarding the challenges the interviewed startups face, they need more support, particularly in financing, regulation, and a sparsely spread ecological culture. "*We had to convince the authorities to obtain the innovation label, which was not easy*", explains the founder of Startup 8. The lack of appropriate funding for the nature of the innovation also represents a significant challenge, as most startups state that state funding still needs to be increased and only sometimes matches the amount required to realize the innovation. Furthermore, investors are only sometimes willing to commit to financing innovations whose return on investment is only evident in the medium or long term.

The main challenge for recycling startups is integrating informal collectors into the official waste management circuit, as regulations need an insertion mechanism to integrate them officially into the recycling process.

Startups involved in eco-construction report overcoming challenges related to recognizing ecological materials and a lack of financial support. "*We had to overcome many challenges to get our ecological materials recognized*", says the founder of Startup 5. This same startup in southern Algeria raised issues related to limited infrastructure, resource inaccessibility, and geographical isolation, which hindered its ability to develop and operate effectively. In addition, the region's conservative nature constituted a form of social resistance at the beginning of the project.

The absence of specific regulations for ecological startups also constrains these types of businesses, which have a distinct professional aspect from ordinary startups.

Discussion

The backgrounds and motivations of the founders of ecological startups reveal a richness of skills and experiences that directly contribute to their ability to innovate. The diversity of training fields and local and international experiences create fertile ground for innovation. Their socially responsible behaviour, stemming from their participation in cleanup campaigns or observation of sustainable development practices abroad, transforms personal ecological challenges into entrepreneurial initiatives. This alchemy between diversified skills and deep motivations fosters a holistic and engaged approach, essential for overcoming traditional barriers to innovation in sectors sometimes resistant to change, enabling the piloting of projects that innovate not only technologically but also socially and managerially by aligning their companies with the United Nations' sustainable development goals. Their ability to win international awards and attract funding highlights the effectiveness of their interdisciplinary and international approach.

The innovations developed by these startups do not stop at introducing new technologies; they redefine interactions between the community, environment, and economy. For example, adopting reward systems granted to households practising selective sorting transforms waste management practices and strengthens community engagement in sustainable development. Using

agricultural waste materials for construction perfectly illustrates how these companies turn environmental problems into economic opportunities while reducing ecological impact. These practices successfully integrate ecological innovation into daily business operations, proving that sustainability efforts can coexist with business longevity. We also observe a direct impact of these innovations on societal well-being, such as opening up rural areas and improving living conditions for specific social categories, particularly rural inhabitants and farmers, through the use of renewable energies (innovations proposed by startups 8 and 9) and invaluable social inclusion effects, such as integrating some informal collectors into the production process by granting them salaries and social coverage.

Startup 5, located in a Saharan area, has had a considerable impact on women in this region. It has encouraged local female entrepreneurship and noticed a change in the community's mindset.

The innovations introduced by the interviewed startups have had significant direct and indirect impacts on society. The founders adopted a positive attitude and were intrinsically predisposed to socially responsible behaviour. This disposition stems from the influence of other international business models, their academic training, or their character traits despite varying perceptions of CSR. Furthermore, the conditions imposed by international funding bodies stipulate that startups must align with sustainable development goals (SDGs) to qualify for funding and international coaching. Our analysis reveals a notable concordance between the ecological goals of startups and their social impact.

In recent years, startups in Algeria have benefited from increased attention from public authorities, marking a significant evolution in the country's entrepreneurial ecosystem by implementing support programs within incubators and accelerators. Interviews conducted with various sector actors confirm this trend, highlighting the importance of initiatives implemented to support innovation and entrepreneurship at the national level, offering young project leaders, whether students or not, a favourable framework to achieve their goals.

These initiatives aim to strengthen the entrepreneurial skills of project leaders and increase their chances of long-term success.

Conclusion

This study explored the impact of ecological innovations on the emergence of CSR practices within Algerian environmental startups. The results demonstrate that these innovations play a decisive role in companies' social and environmental transformation, making them more sustainable and socially engaged. With their diverse academic and professional backgrounds and local and international experiences, the founders of the studied startups adopt socially responsible behaviours and integrate CSR practices into their business models.

However, challenges remain numerous. Regulatory obstacles, limited access to financial resources, and infrastructure constraints, particularly in rural areas, pose significant barriers to startup growth. Additionally, social and cultural barriers, especially for women entrepreneurs, require innovative and inclusive approaches to be overcome.

Strengthening institutional support is essential to encouraging and supporting ecological startups in Algeria. Public authorities should intensify their assistance by simplifying administrative procedures and increasing tax incentives for startups engaged in ecological innovation. Additionally, developing financing mechanisms tailored to the specific needs of ecological startups, such as dedicated investment funds and grants for environmental impact projects, is crucial. Improving basic infrastructure, particularly in rural areas, is also necessary to facilitate the expansion and competitiveness of these startups.

Furthermore, implementing training and mentoring programs focused on sustainable management and ecological innovation to enhance entrepreneurs' skills is recommended. Promoting equal opportunities is also fundamental; specific initiatives to support women entrepreneurs, such as dedicated mentorship programs and support networks, should be developed. Finally, increasing awareness campaigns and educational programs on the benefits of ecological innovation and CSR practices is crucial to fostering a responsible entrepreneurial culture.

Several research perspectives can be considered to deepen the understanding of the dynamics between ecological innovation and CSR. It would be beneficial to conduct longitudinal studies to observe the evolution of CSR practices and the environmental performance of startups over several years.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Publisher's Note: European Academy of Sciences Ltd remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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