

## Integrating ESG Metrics into the Business Model Canvas for Clean Energy Startups

Asaad Belal Othman<sup>1\*</sup>, Mian Muhammad Ajmal Khan<sup>1</sup>, Saif Fahd Mohammed Saeed<sup>2</sup>

<sup>1</sup>Universitas Islam Internasional Indonesia, Indonesia

<sup>2</sup>State University of Malang, Indonesia

\*Corresponding Author, Email: [asaad.othman@uiii.ac.id](mailto:asaad.othman@uiii.ac.id)

---

### Abstract

Startups in clean energy are particularly vulnerable: their technology is capital-intensive and the time horizon is long, and the sustainability expectations are changing. In order to succeed, they need to match business strategy with Environmental, Social, and Governance (ESG) performance and access sustainable finance. This paper is a literature review on sustainable business models and ESG finance, and a proposed Business Model Canvas (BMC), modified to include explicit ESG metrics in all nine of the building blocks it consists of. We use academic and industry sources to provide an example of an ESG-BMC framework that maps example ESG indicators to elements of BMC. Examples of clean-energy projects (e.g., Kenya M-KOPA Solar and Rwanda Bboxx) demonstrate how the incorporation of ESG into value propositions, partnerships, and revenue models may bring in ESG-decentralized capital. In the analysis, we identify that startups that have clearly factored quantifiable environmental and social impact (e.g., reducing carbon footprint, benefiting the community) into their BMC are more likely to receive green funding and better financing options. We deduce that an ESG-conscious BMC assists clean-energy entrepreneurs to develop sustainable models that will appeal to impact investors based on standards such as the EU taxonomy and sustainability standards. This unification is crucial to unlock sustainable finance (green bonds, climate funds, ESG-linked loans), and accelerate clean innovations, and the triple-bottom-line is much more than a reporting practice and is a business strategy.

**Keywords:** *Business Model Canvas, Clean Energy Startups, Green Entrepreneurship, Sustainable Finance.*

---

### INTRODUCTION

The shift toward clean energy will be significant in the prevention of climate change and sustainable development. The startup in renewable energy, energy efficiency, and other related areas is necessary as it introduces new technologies and business models. But these projects are limited in their funding: they have steep capital requirements, take years to develop, and the regulations and market expectations are changing. Meanwhile, worldwide capital is being redirected into sustainable finance - investment that clearly aims at environmental and social objectives (e.g., climate action, low-carbon) (Friede et al., 2015a). Environmental, Social, and Governance (ESG) criteria have been a critical means for investors to filter and appreciate opportunities, and adherence to ESG qualifications is frequently considered to be de-risking and worth enhancing. In this manner, clean-energy startups have a potentially better chance to increase their funding opportunities through incorporating ESG metrics into their strategic approach and reporting (Alazzawi et al., 2024).

Osterwalder and Pigneur (2010) proposed a Business Model Canvas (BMC) as a widely used

business model planning tool, which has 9 elements, starting with value propositions and finishing with revenue streams. However, the original BMC is geared towards conventional businesses and does not pay much attention to the aspect of sustainability. In recent scholarship, there have been suggested sustainability business model canvases, which overlay environmental and social issues (Aagaard, 2024). As an illustration, Joyce and Paquin (2016) generalized the BMC to three layers (economic, environmental, and social). It is the focus of these triple-bottom-line canvases to emphasize how ventures generate value beyond the economic perspective into the ecological and social perspectives as well. Nevertheless, the practitioners do not have a definite process that they can use to operate ESG metrics in the conventional BMC framework. Specifically, clean-energy startups should be advised on what ESG indicators (carbon emissions, resource use, community impact, etc.) are relevant to each element of the business model, and how this relevance can be leveraged to gain access to sustainable finance (e.g., green loans, impact investing, climate grants) (Joyce & Paquin, 2016).

The current paper provides a research-grounded framework for incorporating ESG metrics into the BMC of clean-energy startups. Through a literature review on sustainable business models and venture finance, we will generalize the best practices and suggest that the corresponding ESG indicators be mapped to each block of the BMC (Table 1). We also depict the model by looking at the example of successful clean-energy startups that have incorporated ESG into their designs (e.g., off-grid solar providers). Next, we speak about the benefits of such ESG-BMC integration, improving the capacity of a startup to find sustainable financing, basing our argument on theory and practice. We make both a conceptual and practical contribution: we expand the BMC toolkit of sustainability entrepreneurs and offer support that this integration can enhance access to capital in ESG-consistent markets.

## LITERATURE REVIEW

### BMC and Sustainable Business Models.

Business Model Canvas (BMC) is a strategic template of nine elements (customer segments, value proposition, channels, customer relationship, revenue streams, key resources, key activities, key partnership, cost structure) that assist in defining how the company creates, delivers, and. Most importantly, sustainability is not explicitly defined in the original formulation of the Business Model Canvas. The BMC, according to Autio (2024), was created in the context of for-profit businesses, and the social or environmental impact was not considered. This exclusion has led to a body of research on green business model canvases. In a number of studies, variations of the BMC that explicitly overlay environmental and social issues on the classical model have been proposed. Interestingly, Joyce and Paquin (2016) created a Triple Layered Business Model Canvas (TLBMC) and attached specific environmental and social layers to the economic BMC. Within the framework of Joyce and Paquin, all nine original BMC blocks would be considered in ecological (life cycle) and social (stakeholder) perspectives (Figure 1). Similarly, Upward (2013) and Wit and Pylak (2020) suggested sustainability-oriented canvases that incorporate lifecycle and stakeholder into business-model construction. Such works acknowledge that sustainable innovation needs to rethink the traditional logic of business models - such as replacing renewable inputs

or developing inclusive value propositions (Bocken et al., 2014) - but do not go further to give each block specific ESG metrics.

Figure 1 below shows the core economic canvas as presented by Joyce and Paquin (2016) on a sustainable product (e.g., Nespresso coffee) as our baseline example. The additional layers (not depicted) would contain such considerations as lifecycle carbon footprint in “Key Activities” or fair-wage requirement in “Key Resources. The latest books highlight the fact that, realistically, sustainable business models should be a combination of profit and purpose. According to Santos et al. (2015), the only business model that can be considered truly sustainable is the concept in which the impact and profit missions coexist and complement each other. On the contrary, under-integration may hamper performance; certain research indicates that the disengagement between ESG objectives and business strategy may result in the costs increasing or the possibility of greenwashing. Therefore, the integration of sustainability into central strategy, as opposed to a strategy add-on, is a broadly regarded best practice (e.g., Bocken et al., 2014; Schaltegger et al., 2016). Nevertheless, most entrepreneurs and investors continue to find it challenging to convert the general ESG principles into actual business-model decisions by Alexandre Joyce.

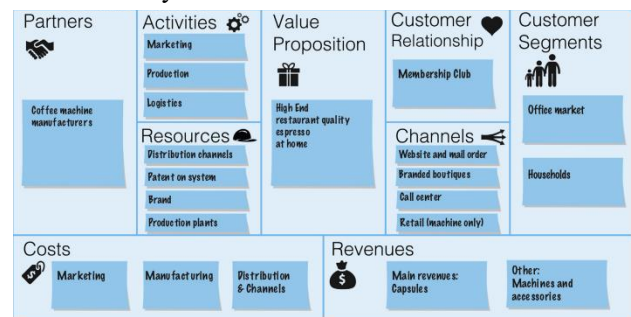


Figure 1: Economic Business Model Canvas for a sustainable product source: (Joyce & Paquin, 2016). While the economic layer focuses on partners, activities, and value proposition, our framework adds ESG metrics (e.g., carbon reduction, social impact) to each element in the integrated ESG-BMC

### ESG Metrics and Frameworks

ESG metrics are quantitative or qualitative indicators of the performance of a company on environmental, social, and governance levels. The main standards are Global Reporting Initiative (GRI) standards, Sustainability Accounting Standards Board (SASB) metrics, and the IRIS+ catalogue of impact

indicators. These frameworks include dozens of potential KPIs: carbon footprint, water consumption, recycling levels of waste (Environmental); labor relations, community relations (Social); board diversity, anti-corruption policies (Governance). In the case of startups, some metrics are more applicable (e.g., greenhouse gases avoided, livelihood improvements enabled) than granular corporate governance metrics.

Scholarly sources indicate that there is a business case for ESG: meta-studies indicate that about 90 percent of evaluations find that the ESG performance is significantly related to financial performance, although not always in a negative direction. That is, ESG-aligned firms are less risky and may have greater returns. Indicatively, Friede et al. (2015b) find that the business case of ESG investing is empirically very well-founded, with most of the studies reviewed indicating positive ESG-performance relationships. Similarly, the findings of other studies also suggest that ESG aspects have the potential to decrease the volatility of stocks and attract long-term investors (Bissoondoyal-Bheenick et al., 2024). But there are still measurement issues: ESG ratings may not be equivalent between providers, and superficial ESG improvement (e.g., calling something green) can cover up less sustainable activities. This highlights the importance of startups applying meaningful and material ESG metrics, preferably those based on the EU Taxonomy or meeting the Sustainable Development Goals, but not hollow checklists (Beerbaum, 2024).

ESG integration can open access to new capital as viewed by entrepreneurs and financiers. Sustainable finance is now emerging, which implies that lenders and investors will attach more importance to verifiable environmental and social outcomes. As an example, green bonds, sustainability-linked loans, and impact-investment funds often demand that a relevant set of ESG KPIs be disclosed. The European Union has gone further to recommend a voluntary SME Sustainable Finance Standard to make disclosures easier and enable access to climate funding by small businesses (Donghui et al., 2025). ESG considerations are being incorporated in due diligence and value creation in the context of private equity (Galema & Gerritsen, 2025). An industry survey conducted in 2024 found that half of institutional investors think that ESG integration can be useful to find growth opportunities, and two in three

think that ESG factors will have an impact on fundraising opportunities. In the case of clean-energy startups, it means that having good ESG performance flow, such as by pledging to make a measurable reduction in emissions or social impact metrics, can render them even more appealing to green financial providers.

### **ESG and Clean Energy Startup Finance**

green tech startups or cleantech startups. These business ventures have been characterized by barriers to financing: expensive R and D, payback time, and technology risk (Mukherjee et al., 2024). Historically, public grants, subsidies, and concessional finance have been an important part of establishing such companies. A systematic review observes that the nature of cleantech is high capital investment, long payback periods, and a disruptive nature, and hence innovative financing instruments and policies by governments are required to mitigate risk and to lure private investment. Meanwhile, impact-oriented investors are increasingly requesting financing of initiatives that can achieve measurable, sustainable results (Falchetta et al., 2022). Clean-tech startups fit well with climate targets across the world (e.g., Paris Agreement) and are a logical choice when dealing with green bonds and blended-finance vehicles (World Bank, n.d.).

Other startups actively implement ESG objectives to indicate their sustainable purpose. Nevertheless, the disposition of founders is different. Based on field experiment research involving U.S. startup founders, Zhang (2024) found that although non-financial satisfaction with ESG alignment was common among many entrepreneurs, they were also worried that the green investor might require them to compromise on profitability. As a matter of fact, his research revealed that founders feel that such partnerships [with ESG-oriented VCs] might be disruptive of profitability, particularly with smaller or more traditional-industrial startups. This brings out the tension; startups desire ESG credibility but are also concerned about cost and control. However, there is other evidence that indicates that real ESG incorporation may provide financial advantages. To illustrate, the ESG represents more of a supplement than a silver bullet to raising capital according to one Swedish clean-tech entrepreneurial study, in which one respondent claimed that the ESG-friendly nature of their product in reducing emissions was attractive to potential investments in a post-ESG complanciva-portal.org (Mansouri & Momtaz, 2022).

## METHODS

This research is conceptual and exploratory. We conducted a systematic review of scholarly and industry literature on sustainable business models, ESG metrics, and clean-energy finance (2014–2025). Based on this review and on existing BMC adaptations (e.g., triple-layer canvases), we developed a proposed framework mapping ESG metrics to the BMC's nine blocks. The framework was iteratively refined through qualitative case study analysis (Hassan et al., 2024). We selected illustrative case studies of clean-energy startups from secondary sources: a qualitative study of Swedish cleantech venturesdiva-portal.orgdiva-portal.org and reports on African off-grid solar companies. From these sources, we extracted examples of how companies integrated ESG into their value proposition, partnerships, and funding models. This approach allows us to ground the framework in real-world practice, even though it is not a formal empirical study.

A key output is Table 1, which presents sample ESG indicators aligned with each BMC component. These indicators draw on GRI/IRIS taxonomy, industry best practices, and case evidence. Visual ESG-BMC – illustrating how an integrated canvas might look for a hypothetical clean-energy startup (for example, a solar home-system company). (Note: Figures and tables are conceptual and for illustration; detailed validation is suggested for future work.)

### ESG-Integrated Business Model Canvas Framework

Based on the original BMC and its sustainability versions, our framework allocates some example ESG measurements to each block of canvas. Table 1 is a summary of the mapping. Key highlights include: Value Proposition. Startups in clean energy tend to sell a product or service that is beneficial to the environment (e.g., solar kits, biogas systems). ESG indicators in this case might be the tonnes of CO<sub>2</sub> not emitted, renewable energy produced, the number of low-income households powering up their lights, the number of products certified as climate-positive, etc. It is important to note that even the process of stating a powerful mission of cutting emissions or enhancing health can be a differentiator (Aagaard, 2024).

Customer Segments & Channels. ESG integration refers to serving segments that care about sustainability (e.g., B2B corporate customers in need of ESG supply chains, or BOP customers through mobile money).

Measures could be customer impact (e.g., customer satisfaction with sustainability, or number of women or marginalized beneficiaries served), and the communication channels could focus on impact storytelling (although communication measures are more qualitative) (Seok et al., 2024).

Customer Relationships. We also have ESG indicators of stakeholder involvement, such as community involvement scores or co-design with local communities, indicative of social acceptance and governance of stakeholder processes (Chen et al., 2024).

Key Activities. These are the value-creating activities. In the case of clean tech, production, installation, and maintenance are major activities. ESG indicators may consist of such areas as resource efficiency (energy/water consumed per unit produced), recycling of components, and worker safety rates. This could be quantified through product life-cycle analyses (e.g., cradle-to-grave design), such as product lifecycle GHG emissions. (Chen et al., 2024).

Key Resources. This block consists of human, physical, intellectual, and financial capital. Resource-based ESG indicators may include renewable energy consumption in the business, share of local suppliers, or employment indicators (e.g., share of workers having safety training, management diversity). There could also be access to green intellectual property (e.g., patented clean tech) (Aagaard, 2024).

Key Partnerships. Cases involving partnerships with NGOs, governments, or green technology companies are likely to be with clean energy. We recommend monitoring the percentage of sustainability suppliers audited, investor ESG requirements (e.g., percentage of capital raised by impact funds), and partnerships with environmental research institutions. The cooperation with the carbon offset or renewable integration (e.g., partnership with ecosystem restoration projects) could be counted (Permatasari & Gunawan, 2023).

Cost Structure. In this case, it is possible to consider cost factors that are used in ESG. As an illustration, investment in sustainable R&D, or the saving of energy efficiency (to demonstrate long-term viability), and the cost of carbon offsets purchased. They can be compared to any environmental liabilities.

Revenue Streams. In addition to selling the products, ESG-conscious startups can include green revenues or subsidies. Measures are the share of



revenue of certified green products, the amount of grant or concessional funding received, and pricing premiums of products meeting ESG requirements. Certain startups apply unique financing (i.e., pay-as-you-go solar) – revenue measures may include a fraction of business revenue attributable to impact-based financing.

**Mission Integration.** We have included an explicit Impact Mission component to our adapted canvas (inspired by the Triple Bottom Line Canvas). This mission expresses the fundamental ESG goals of the venture (e.g., allow 1M households to go solar by 2030 or achieve net-zero operations). All other elements are anchored on mission metrics (e.g., progress toward emissions goals, social outcomes), to make sure that there is vertical coherence (Aagaard, 2024).

The canvas is a strategic ESG planning tool by having every BMC block matched to a quantifiable ESG indicator. Examples of such metrics are shown in Table 1. Notably, such mapping is supposed to be customized: not all metrics apply to all startups. Every venture is supposed to choose indicators that are significant to their technology and market. Nevertheless, when looking at ESG as a step-by-step process, i.e., value creation or finance, entrepreneurs can create models that are inherently designed to deliver sustainable results, not an addition of ESG.

Table 1. Example mapping of ESG metrics to Business Model Canvas components for clean-energy startups

Business Model Block	Sample ESG Metrics/KPIs
Value Proposition	Tonnes of CO <sub>2</sub> avoided per year; % energy from renewables; number of underserved households served; product eco-labels.
Customer Segments	% customers in low-income or rural segments; customer survey on sustainability impact; number of women customers served.
Customer Relationships	Community engagement sessions held, stakeholder partnerships, and customer health/safety benefit index.
Channels	Digital vs. field channels for underserved areas; info on impact via channels (e.g., usage of apps to report benefits).

Key Activities	Energy/water used per unit produced; % of waste recycled; number of product life-cycle analyses conducted; safety incidents.
Key Resources	% renewable energy in operations; diversity of workforce; certified sustainable materials used; human-capital ESG training.
Key Partnerships	% suppliers audited for ESG; of NGO or government collaborations; total green equity raised; DFI or ESG fund backing.
Cost Structure	Costs of sustainable inputs (e.g., eco-materials), carbon offset expenses, savings from efficiency measures, and externalities internalized.
Revenue Streams	% revenue from ESG-premium products, amount of green grant or subsidy income, and sustainability-linked loan triggers met.
Impact Mission	Progress toward stated mission (e.g., MW installed, CO <sub>2</sub> target met); third-party impact verification (e.g., GRI report scores).

Note: The above table is illustrative. Startups should choose the most material ESG metrics for their industry and stakeholders.

### Case Study Analysis

We use the examples of start-ups that are about to implement ESG in their models to base the ESG–BMC framework. Although it is too broad for this research to develop comprehensive primary case research, secondary sources can be informative in the form of instructive vignettes.

**Case 1- Swedish CleanTech Startups (Qualitative Study).** Recent research of seven Swedish clean-tech startups discovered that their business models focused on environmental sustainability and that this affected the value creation and investor. A single company that makes carbon-removal credits specifically sells its product to companies that aim to achieve ESG compliance and reputation benefits, according to the respondents of the interview. Sustainability activities served as a point of sale to new investors. As was reported by one of the founders, sustainability initiatives led to higher profitability and even new

investors. Regarding the BMC, such companies had ESG embedded in their value propositions (e.g., negative-emission product), alliances (e.g., DFI support), and resource policies. As an example, they used sustainability certifications and carbon credits to design revenue streams. These examples can underpin our structure: the startups would be able to show financial metrics to ESG-conscious investors (e.g., environmental impact (e.g., carbon removed) and social impact (e.g., local employment created)) (Rizzitello et al., 2025).

Case 2 – M-KOPA Solar (East Africa). M-KOPA is an off-grid provider of solar-powered devices based in Kenya, which serves more than 3 million households in East Africa. Its business model (like a BMC) is based on pay-as-you-go financing through mobile phones to underserved rural clients. Importantly, M-KOPA has actively monitored and reported the environmental and social effects: the company boasts that its solar systems have prevented millions of tonnes of CO<sub>2</sub> emissions and, in the process, constructed the credit history of customers. This impact story has opened the ESG capital door: in 2022, M-KOPA raised more than 75 million ESG-oriented funds through investments by such investors as CDC Group (BII), Lightrock, and Generation Investment Management. This value proposition (access to cheap, clean energy) and customer segments (low-income off-grid consumers) directly create environmental benefits (reduced use of diesel) and social benefits (access to electric light, education hours). These metrics, which are reported by M-KOPA to investors, can be categorized in our model: its revenues are international climate funds (incentives), and its core partners are impact-oriented investors and NGOs. The example of M-KOPA in our ESG-BMC terminology demonstrates the effectiveness of introducing measurable impact to each block: emissions avoided (Value Proposition), percent of rural households served (Customer Segments), customer financing KPIs (Revenue Streams), etc., are all measurable ESG targets.

## RESULTS AND DISCUSSION

Case 3 – Bboxx (Rwanda/DRC). Bboxx is a technology-based micro-utility that provides solar and digital services at the bottom of the pyramid. Bboxx is a company that operates in Rwanda, DRC, and Kenya, selling smart solar kits with Internet-of-Things connectivity with a focus on rural electrification. It has

collaborated with governments and development finance institutions (DFIs) - one such Key Partnership that can facilitate more social reach. In Rwanda, a government alliance made off-grid services available to more than 100,000 families. The Bboxx model focuses on performance monitoring based on the data: sensors on its solar units will gather usage data, and this information will optimize the service and ensure the impact. The ESG-oriented business at Bboxx has been funded by impact investors (e.g., Global Energy Alliance, Engie Rassembleurs Energies, Mitsubishi). Community training and data analytics are the key activities of Bboxx based on BMC, with the measures being the energy offered and the number of hours that electricity was supplied. Its Value Proposition (low-cost clean energy + connectivity) has resulted in less kerosene consumption and high productivity. The success of Bboxx provides an example that intensive monitoring of impact and alignment with development objectives would allow creation of access to specialized capital (green funds and strategic corporate partners) - as our framework predicts, integration of ESG metrics would open access to sustainability finance.

Together, these cases demonstrate that clean-energy startups with embedded ESG metrics tend to attract sustainable finance. Both M-KOPA and Bboxx highlight “clear, measurable impact alongside financial returns” as attractive to ESG investors. In our framework, these companies scored highly on metrics in multiple BMC blocks (e.g., demonstrable CO<sub>2</sub> abatement in Value Proposition; inclusive reach in Customer Segments; impact-linked partnerships). The Swedish cases similarly connect their ESG values to investor appeal. We did not find contrary examples of clean-energy startups failing due to ESG integration, though the literature warns that superficial “ESG-washing” can erode trust (e.g., de Freitas Netto et al., 2020). The key lesson is that credible ESG performance must be *embedded* in the business model rather than treated as marketing flair.

Our review and case analysis underscore several insights about ESG–BMC integration and sustainable finance:

1. ESG alignment strengthens financing prospects. Consistent with the case studies and broader trends, startups that quantify their environmental and social impact are better positioned in the sustainable finance ecosystem. Empirical evidence

suggests ESG-aligned companies often enjoy *risk reduction* and investor confidence. For clean-energy ventures, ESG metrics (e.g., megawatts installed, emissions reduced) serve as signals of mission fulfillment, attracting impact investors and concessional financing. Sustainable finance instruments increasingly require such reporting – for example, sustainability-linked loans tie interest rates to ESG targets, and green bonds demand use-of-proceeds alignment with climate goals. By mapping ESG into the BMC, a startup can ensure it collects the data needed to qualify for these instruments (Friede et al., 2015b).

2. BMC provides ESG opportunities in every part of the component. As Table 1 demonstrates, ESG metrics may be incorporated in every aspect of the business model. To illustrate, Key Activities measures may not only cover product output, but may also involve efficiency of resource consumption, whereas Revenue Streams may involve subsidies of renewable implementation. Practically, startups are supposed to align their BMC blocks towards sustainability (Mandas et al., 2023). As an example, the BMC of a solar venture could include, as Key Partnerships, local solar panel recyclers, as well as buyers of carbon credits, which a traditional BMC would not directly reflect on. Entrepreneurs transform sustainability into an operational reality by making conscious adaptations at every element instead of an abstract vision (Fadila et al., 2024).
3. ESG integration can present trade-offs. While aligning with ESG is broadly positive, it can involve short-term costs or constraints. Zhang (2024) found that some founders fear ESG investors may impose lower profit expectations. The Triple Bottom Line Canvas literature also warns that misaligned impact missions can strain profitability. Thus, startups must strike a balance: invest enough to meet ESG targets, but in ways that can become profit drivers rather than drains. For example, a clean-energy startup might initially forget higher margins by sourcing locally or hiring disadvantaged workers (raising costs), but over time, these practices can build customer loyalty and investor reputation. In our adapted canvas, *vertical coherence* (alignment across all layers) is crucial, so ESG actions reinforce, not undermine, the business model (Aagaard, 2024).

4. It is important to standardize and to be accountable. To enhance credibility, the startups must be aligned with the accepted ESG standards (GRI, SASB, EU Taxonomy). Standardized disclosure is usually demanded by financial stakeholders. As an illustration, the African technology M-KOPA is audited on its impact independently to investors. This implies adding a Governance aspect (out of our present blocks) to the canvas, which relates to how the startup monitors, reports, and audits ESG performance. As an example, startups can implement the third-party certification or make ESG expertise one of the core assets of the company. By doing this, the BMC will not only promote operational integration but also meet compliance and investor requirements (Asmaraningtyas et al., 2024).
5. Context Policy and ecosystem context are important. When we have the external sustainable finance infrastructure, our framework is best. The benefits of ESG alignment can be enhanced by using public policy (e.g., tax incentives, green procurement) and finance platforms (e.g., climate funds, development banks) (Mukherjee et al., 2024). As a case in point, the Rwanda deployment of Bboxx has been made possible by governmental cooperation and foreign DFI. Areas that have established ESG ecosystems (such as EU member states with taxonomy laws) can have ESG-compliant models more easily started up. In this way, startups must look beyond the immediate finance field: mapping their BMC to capitalize on existing green financing support and partnerships.

Practice and Research Implications. To practitioners, the ESG-BMC is an organized thinking framework where sustainability can be considered a strategy. Through Table 1, entrepreneurs will be able to audit their model on ESG gaps (e.g., no resource use metrics) and establish targets. Similar canvases might be used to compare a startup pitch by investors and accelerators: an open ESG-BMC will allow identifying undisclosed risks or opportunities. On an academic level, our model is open to additional validation: future empirical research can examine whether startups based on an ESG-conscious canvas indeed raise more funds or hit the ground running sooner than other ones. It also raises thematic issues of metric refining (which KPIs best predict financing success?) and about widening the canvas (e.g., an additional layer of governance).

## CONCLUSION

The proposed work incorporates the ESG performance implications into the traditional Business Model Canvas, adapted to the sustainable finance era and clean energy startups. We came up with a concrete mapping of ESG metrics to both elements of the BMC (Table 1) and explained how the adapted canvas can be used to design and assess ventures. The examples of Swedish clean-tech companies and African solar companies show that the startups that consider the quantifiable environmental and social value in their business models are more likely to attract sustainable fundingdiva-portal.org. Notably, ESG integration will become not only a reporting effort but also a strategy: it fosters value propositions, creates impact-focused partnerships, and opens the door to financing avenues related to sustainability.

When focusing on the ESG integration, we believe that the clean-energy entrepreneur makes itself more appealing to investors and helps the global goals. This compatibility helps to access the green bonds, sustainability-linked loans, and impact investment funds that are becoming increasingly significant in the financing environment of the energy sector. Finally, the ESGBMC framework below will be used to enable startups to transform their impact missions into profit drivers: with environmental and social ambitions being put on record in all aspects of the scheme, startups will be able to make sure that their sustainability initiatives are financially feasible and scalable. Startups that are not able to illustrate the value of ESG can find it difficult in a world where finance is increasingly becoming green. In comparison, the ones that actively incorporate ESG measures into their business model are more likely to dominate the clean energy shift and get the capital to scale.

## REFERENCES

- Aagaard, A. (Ed.). (2024). *Business Model Innovation: Game Changers and Contemporary Issues*. Springer International Publishing.
- Alazzawi, S., Mahmood, W. A., & Shihab, S. K. (2024). Comparative study of natural fiber-Reinforced composites for sustainable thermal insulation in construction. *International Journal of Thermofluids*, 24, 100839.
- Asmaraningtyas, L. W., Rahmawati, I. D., & Fitriyah, H. (2024). Green Business Innovation: Sustainable Business Model Development through Integration of Business Model Canvas, Design Thinking, and Islamic Business Ethics. *Golden Ratio of Marketing and Applied Psychology of Business*, 4(1), 57–74.
- Beerbaum, D. (2024). *The search for an holistic ESG Taxonomy*.
- Bissoondoyal-Bheenick, E., Bennett, S., Lehnherr, R., & Zhong, A. (2024). ESG rating disagreement: Implications and aggregation approaches. *International Review of Economics & Finance*, 96, 103532.
- Chen, W., Xie, Y., & He, K. (2024). Environmental, social, and governance performance and corporate innovation novelty. *International Journal of Innovation Studies*, 8(2), 109–131.
- Donghui, Z., Yusoff, W. S., Salleh, M. F. M., Lin, N. S., Jamil, A. H., Abd Rani, M. J., & Shaari, M. S. (2025). The impact of ESG and the institutional environment on investment efficiency in China through the mediators of agency costs and financial constraints. *Social Sciences & Humanities Open*, 11, 101323.
- Fadila, R., Asnawi, Y. H., & Taryana, A. (2024). Sustainable Business Model Development of Salam Rancage Bogor Using Triple Layered Business Model Canvas. *Indonesian Journal of Business and Entrepreneurship*.
- Falchetta, G., Michoud, B., Hafner, M., & Rother, M. (2022). Harnessing finance for a new era of decentralised electricity access: A review of private investment patterns and emerging business models. *Energy Research & Social Science*, 90, 102587.
- Friede, G., Busch, T., & Bassen, A. (2015a). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233.
- Friede, G., Busch, T., & Bassen, A. (2015b). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233.
- Galema, R., & Gerritsen, D. (2025). ESG rating changes and stock returns. *Journal of International Money and Finance*, 154, 103309.
- Hassan, A. A., Mokhtar, N., Husin, M. S. H., & Hassan, F. (2024). Sustainable Finance and the Financial Sector: A Conceptual Exploration of



ESG's Role. *International Journal of Research and Innovation in Social Science*, VIII(IX), 1240–1257.

- Joyce, A., & Paquin, R. L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, 135, 1474–1486.
- Mandas, M., Lahmar, O., Piras, L., & De Lisa, R. (2023). ESG in the financial industry: What matters for rating analysts? *Research in International Business and Finance*, 66, 102045.
- Mansouri, S., & Momtaz, P. P. (2022). Financing sustainable entrepreneurship: ESG measurement, valuation, and performance. *Journal of Business Venturing*, 37(6), 106258.
- Mukherjee, A., Owen, R., Scott, J. M., & Lyon, F. (2024). Financing green innovation startups: A systematic literature review on early-stage SME funding. *Venture Capital*, 1–27.
- Permatasari, P., & Gunawan, J. (2023). Sustainability policies for small medium enterprises: WHO are the actors? *Cleaner and Responsible Consumption*, 9, 100122.
- Rizzitello, E., Piazza, M., & Perrone, G. (2025). Unlocking green startup investments: How environmental policy pressures drive Venture Capital funding decisions. *Technological Forecasting and Social Change*, 217, 124158.
- Seok, J., Kim, Y., & Oh, Y. K. (2024). How ESG shapes firm value: The mediating role of customer satisfaction. *Technological Forecasting and Social Change*, 208, 123714.
- World bank. (n.d.).
- Yadav, P., Heynen, A. P., & Palit, D. (2019). Pay-As-You-Go financing: A model for viable and widespread deployment of solar home systems in rural India. *Energy for Sustainable Development*, 48, 139–153.
- Zhang, Y. (2024). *Startups' Strategies for Green Funding Adoption*.