Original Research Article

Sustainability Finance for SMBs in the United States: Unlocking Capital for Green Innovation

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ABSTRACT

Small and medium-sized businesses (SMBs) account for 90% of enterprises in the United States and contribute significantly to the national economy. However, they encounter major challenges in accessing capital for sustainability projects and green innovation that could hinder progress toward the U.S. government's climate goal of achieving net-zero greenhouse gas emissions by 2050. This study draws on original survey data from 42 SMBs across multiple industries in South Florida and finds a significant gap between SMBs' interest in sustainability finance and their ability to access available resources. While 90% of surveyed SMBs expressed interest in funding sustainability projects, all respondents identified complex financial channels as a major deterrent. Moreover, only 20% had any knowledge of federal and state-sponsored loan programs that incentivize green investments. Using a combination of primary survey data, secondary policy and market research, this study reveals that barriers to SMB sustainability finance are more informational and structural than capital-related. Additionally, the findings of this research highlight the importance of targeted interventions to improve access to sustainability finance that can help unlock green innovation potential for American SMBs in the context of national climate goals and economic competitiveness.

Keywords: Sustainability Finance; Small and medium-sized businesses; Green financing barriers; SMB sustainability awareness; SMB sustainability adoption; Federal green loan programs for SMBs

INTRODUCTION

The switch to a sustainable economy is one of the biggest economic transformations occurring in the 21st century, and small- and medium-sized businesses (SMBs) are crucial contributors to national climate goals and environmental sustainability objectives (1). In the U.S., SMBs account for around 90% of businesses and over 50% of the labor force, therefore, their involvement in the green transition is critical to the goal of becoming carbon neutral by 2050 set by the Biden government (2, 3). This is also consistent with a 2024 study by the Organization for Economic Cooperation and Development (OECD) that concludes that the global attempt to reach net zero emissions by 2050 cannot be realized without SMBs' involvement (4).

The global sustainable finance market has soared, reaching $895.12 billion in 2024 and is estimated to increase to $5.06 trillion by 2032, at a compound annual growth rate (CAGR) of 24.19% by the end of 2032 (5). Despite this rapid market expansion, SMBs face disproportionate barriers to accessing these funds, creating a significant gap between available capital and actual utilization. In the U.S., the financing gap for SMBs pursuing sustainability initiatives is all the

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more acute because traditional lenders do not consider the overall benefit in the long term, nor the risk profile, associated with such green investments. This research fills a pressing research gap on how sustainability finance can be structured and delivered to realize the green innovation potential of U.S. SMBs by exploring the barriers and opportunities inherent in current and new financing institutions.

The goal of this study is to provide an all-round view of the sustainability finance ecosystem for SMBs in the U.S. by analyzing existing financial mechanisms, barriers, and possibilities for increasing financing opportunities for green innovation. Using a structured review of up-to-date data, recent policy interventions, and case studies, this study offers insights into sustainable finance for policymakers, financial institutions, and the SMB sectors.

LITERATURE REVIEW

The Role of Sustainable Finance in Enabling Green Innovation

The intersection of sustainability and finance has become a key element in global climate policy and strategy, especially for SMBs. A 2024 study by Ogunyemi and Ishola at Eastern Illinois University illustrates that sustainable finance mechanisms (e.g. green loans, bonds, tax breaks) can contribute significantly to the reduction of initial costs to adopt renewable energy (6). Their findings highlight how financial accessibility can significantly spawn the green transition of U.S. based SMBs when paired with advisory and consulting support.

Although their research has been successful in identifying the supply-side benefits associated with sustainable finance (financial institutions, policy incentives, and consulting frameworks), the authors fail to address the demand-side barriers facing SMB participation. On the other hand, the current study adds to that shortfall by using original survey data from 42 South Florida SMBs, which indicates that 100% of respondents were more concerned about the burden of the complicated aspects of funding processes as one of the barrier factors. Such empirical evidence of informational and structural constraints (as opposed to the lack of capital) underpins the argument that they constitute the key constraint on SMBs—an argument which extends and critiques the more general findings of Ogunyemi and Ishola (2024).

Comparative Analysis of Green Finance Mechanisms

In the current landscape, green financing involves a wide range of instruments such as green bonds, government-backed loans, and public–private investment initiatives. Ogunyemi and Ishola (2024) highlight green bonds and impact investing as scalable ways to achieve sustainability, noting that early adopters reported improved return on investments. But the main case studies use mid-sized manufacturing enterprises with established credit profiles as the subject. This reduces the application of their inferences to smaller, service-oriented SMBs, which frequently do not have collateral or administrative capacity to access such funds.

This research builds on this by examining specific federal and state programs—namely the Small Business Administration (SBA) Green Lender Initiative, United States Department of Agriculture's (USDA) Rural Energy for America Program (REAP) grants, Department of Energy's (DOE) Small Business Innovation Research (SBIR) Small Business Technology Transfer (STTR) programs, and Property Assessed Clean Energy (PACE) financing program—in action. These mechanisms indicate that bespoke financial products, especially those reducing transaction costs and offering longer repayment terms, are more suitable to SMB operational realities. This study adds to the existing literature's macroeconomic focus by establishing green financing context, particularly in SMBs, in a micro-level, data-driven context.

Consulting and Technical Support: Bridging the Knowledge Gap

Ogunyemi and Ishola (2024) highlight sustainability consulting as an important factor in helping small and medium-sized businesses (SMBs) transition to greener operations, noting that businesses receiving technical advice can reduce their energy use by 15–20%. However, their study assumes that such consulting support is widely available. The present research questions this assumption, showing that only 4 out of 42 surveyed small and medium-sized businesses (SMBs) were aware of state programs like PACE, and only one had heard of green bonds. These results indicate that without stronger awareness efforts and digital outreach, consulting services tend to reach only firms already interested in sustainability, which increases inequality in access instead of reducing it.

Barriers to SMB Sustainability Finance

Both studies acknowledge persistent barriers to green finance, though they differ in emphasis. Ogunyemi and Ishola (2024) highlight high consulting costs, regulatory

uncertainty, and limited awareness as universal obstacles. Their work proposes enhanced partnerships between consulting firms and financial institutions as a corrective strategy. The current research confirms these challenges but further identifies a deeper administrative and informational deficit as the structural bottleneck within the U.S. SMB ecosystem. Specifically, the South Florida survey revealed that **none** of the participants were aware of digital green loan marketplaces such as Zero Circle, Lendio or Biz2Credit. This lack of visibility underscores the need for simplified, technology-driven processes that reduce access to critical information—a dimension largely absent in the Ogunyemi and Ishola framework.

Integrating Policy and Practice

Ogunyemi and Ishola (2024) recommend further expansion of government incentives and policy reforms to increase access to green financing. Their study primarily views policy intervention as a top-down approach driven by federal and state-level programs. On the other hand, the current research promotes a bottom-up approach centered on digital accessibility, local technical assistance, and inter-agency coordination. The results of successful models such as REAP and PACE indicate that hybrid mechanisms, combining federal guarantees with local implementation, are most effective in translating policy intent into practical outcomes for SMBs. This comparative insight suggests that while prior studies provided valuable conceptual foundations, a data-informed, regionally adaptive model is essential for scaling sustainability finance inclusively.

Critical Evaluation and Research Contribution

In summary, Ogunyemi and Ishola (2024) offer a solid theoretical foundation that relates sustainable finance and SMB performance without empirically quantifying barriers that are actual in the U.S SMB ecosystems. The present research extends that work with field data on the levels of awareness, the deterrent effect of application complexity, and gaps in program reach. Through a triangulation of literature synthesis and close-up SMB evidence, this study contributes to synthesizing the theoretical and applied sides of sustainable finance. It concludes that unlocking SMB-led green innovation entails more than just financial instruments, but also simplified application systems, integrated advisory networks, and digital access platforms — which provides a more operationally-based pathway to action for policymakers and financial stakeholders in the U.S.

METHODS AND MATERIALS

Research Design

This study uses a mixed-methods research design combining primary survey data with a structured analysis of secondary data sources while providing depth and context essential for understanding the complex factors shaping SMB access to sustainability finance. The research framework consists of three interconnected phases: First, conducting a survey of South Florida SMBs to quantify awareness, barriers, and financing behaviors. Second, a structured review of federal and state sustainability finance mechanisms and their accessibility characteristics; and third, an analysis of private sector financing options.

Primary Data Collection: South Florida SMB Survey

Survey Design and Development

The survey was designed to assess three core dimensions of SMB engagement with sustainability finance:

First, it measured the priorities of SMBs to invest in sustainability projects and their interest in securing funding for those projects. The second objective was to identify specific barriers and constraints faced by SMBs that impact their decision to access available financing programs. The third objective was to measure awareness of various federal, state, and private financing options available to them.

Sampling Strategy and Participant Recruitment

The study targeted SMBs operating across a wide range of industries in South Florida, specifically Miami-Dade, Broward, and Palm Beach counties. This region was chosen for three strategic reasons:

South Florida is consistently impacted by a number of immediate climatic changes including rising sea levels, severe weather conditions, and flooding - all of which have an impact on businesses regardless of their size. South Florida's economic diversity that includes various industries including tourism, agriculture, manufacturing, professional services and technology offers helpful insights to gauge the sustainability finance needs of various sectors. Lastly, Florida's regulatory framework and program development landscape offer lessons applicable to other states with comparable market structure and political backgrounds.

Participants were recruited through multiple channels, including regional chambers of commerce, business

associations, and direct outreach to SMBs identified through public business directories and referrals from participating businesses. Only South Florida businesses with 5 to 250 employees that have been in business for at least two years were included in the survey. The survey was distributed to 78 SMBs, of which 42 completed responses were received, resulting in a response rate of 53.8%.

Data used in this study were collected exclusively through an anonymous online survey. Respondents were not asked to provide any personally identifiable information, including business names, owner identities or other contact details. The survey collected only general business characteristics, such as industry sector, number of employees, and years of operation. Participation was entirely voluntary, and informed consent was obtained from all participants prior to data collection. This study was exempt from Institutional Review Board review, as it involved anonymous survey data collection with no personally identifiable information.

While a few in-person conversations were conducted as part of this research to understand the overall SMB experiences, no data from these interactions were incorporated into the analysis. All results presented in this study are based solely on responses from the anonymous survey.

Sample Characteristics

The final sample comprised 42 SMBs with 67% of those being small businesses (size: 5-50 employees) and 33% of those being medium businesses (51-250 employees). The sample represented a diverse range of sectors, including agriculture and food production, healthcare and wellness, technology and innovation, manufacturing and construction, retail and hospitality, and professional services, as illustrated in Figure 1.

The use of non-identifiable, aggregated data allowed for the protection of participant confidentiality while still enabling meaningful analysis of trends across different sectors and firm sizes. Data collection occurred between August and September 2025.

Figure 1 reports the percentage of respondents in each industry category: professional services (29%), retail and hospitality (21%), manufacturing and construction (19%), technology and innovation (17%), healthcare and wellness (9%), and agriculture and food production (5%). The figure describes the sectoral composition of the study sample used for subsequent analyses of sustainability-finance awareness, barriers, and application behavior.

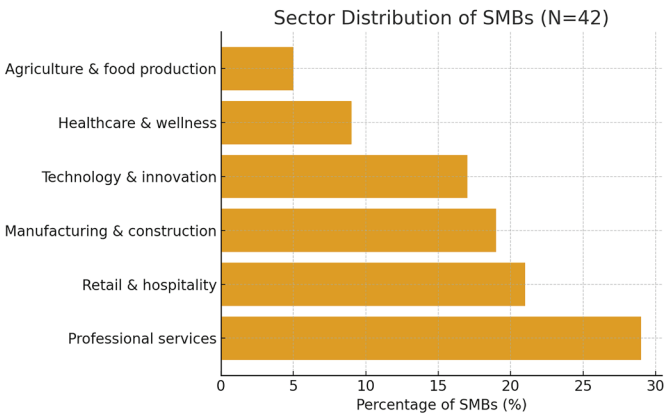

Figure 1. *Sector distribution of the 42 surveyed SMBs in South Florida between August - September 2025.*

Data Analysis Methods

Descriptive statistical analyses of the quantitative survey data were performed as follows: frequency distributions and percentages were calculated for the categorical variables and cross-tabulations were analyzed to examine relationships between business characteristics and financial awareness. Chi-square tests of independence were performed to assess whether awareness and reported barriers varied by business size (small vs. medium SMBs). Statistical significance was evaluated at the 0.05 level. Analysis of awareness of federal finance programs showed no statistically significant association with firm size ($\chi^2(1) = 1.24$, $p = 0.27$), indicating that awareness gaps are broadly consistent across SMB categories.

Qualitative responses were analyzed using thematic coding to identify recurring themes found in SMB experiences and concerns. This analysis provided the background to the quantitative findings and to establish actionable policy recommendations.

Secondary Data Collection

To interpret primary findings as well as to explore the larger sustainability finance context, secondary data from grey literature sources were used to provide critical market-specific context. This included sources from Government agencies such as the U.S. Small Business Administration (SBA), the Department of Energy (DOE), and the U.S. Department of Agriculture (USDA), particularly through sustainability-specific programs such as the Rural Energy for America Program (REAP).

To complement this, datasets, case studies and reports from international and research-based sources such as the

International Finance Corporation (IFC), Organization for Economic Co-operation and Development (OECD) and International Chamber of Commerce were incorporated. Industry and market reports were also analyzed to capture current trends in financial institution engagement, market growth, and emerging financing mechanisms.

The secondary data component was conducted as a structured narrative review rather than a formal systematic review. Sources published between 2020 and 2025 were primarily used as part of the data collection process to capture current market conditions and recent policy developments. While no formal systematic review protocol was used, all secondary sources were evaluated for methodological rigor, and relevance to the U.S. market trends.

RESULTS

South Florida Survey Findings: Overwhelming Interest in Sustainability Finance

Survey results indicated that SMB interest in sustainability finance —90% of participants (n=38) expressed their willingness to pursue capital for green investments. This finding within the South Florida sample suggests that SMBs may be more motivated to pursue sustainability initiatives than commonly assumed. When asked to rate sustainability investment priority on a scale of 1-10, respondents reported an average rating of 7.8 (SD=1.6), with 71% (n=30) rating "7 or higher". This prioritization continued across the range of business sizes and types and sectors, suggesting that sustainability issues are now more widely considered. Qualitative answers confirmed this quantitative observation:

"We know we need to reduce energy costs and improve efficiency. It's not the question of doing it but of how to afford it." (Manufacturing SMB, 45 employees). "Our clients are now frequently inquiring about our sustainability practices. It's becoming not just a nice-to-have thing but rather a competitive necessity." (Professional services firm, 28 employees),

Common Barriers: Process Complexity as Primary Deterrent in the South Florida Sample

Despite overwhelming interest, survey results document severe constraints preventing SMBs from acting on their stated priorities. Most strikingly, 100% of participants (n=42) identified complicated funding processes as a major deterrent to securing green loans. This unanimous response within the sample underscores the severity of administrative barriers facing SMBs.

When asked to elaborate on process complexity, respondents consistently described a set of interconnected challenges that together create substantial barriers to participation. Documentation requirements emerged as the most frequently cited issue (76%, n = 32), with respondents noting that extensive paperwork, including financial statements, project specifications, environmental impact assessments, and business plans, can overwhelm SMBs that lack dedicated administrative staff.

Closely related to this, 67% of respondents (n = 28) emphasized the length and complexity of application processes. Many described multi-stage procedures that require technical expertise, which SMBs often do not possess and must obtain through costly external consultants. In addition, unclear eligibility criteria were reported by 62% of participants (n = 26), with respondents expressing difficulty determining whether their projects qualified for specific programs. This uncertainty frequently resulted in wasted time and effort on applications that were ultimately deemed ineligible. Moreover, long processing times were another significant concern, cited by 57% of respondents (n = 24). Delays between application submission and funding decisions often exceeded SMBs' operational timelines, creating uncertainty and discouraging continued engagement with funding programs.

These challenges extend beyond procedural issues and have direct implications for business decision-making. As one respondent explained, "I spent three weeks trying to understand if we qualified for an SBA green loan. The forms required information we don't track in our accounting system. By the time I figured it out, I'd missed a deadline and had to wait six months to reapply. We ended up abandoning the whole project" (Retail SMB, 18 employees).

Statistical analysis further indicates that concerns regarding process complexity did not vary significantly across business size or sector, suggesting that these barriers are systemic and affect SMBs broadly, regardless of their characteristics.

Critical Awareness Gaps in Federal Program Knowledge

Survey findings highlight alarmingly low levels of SMB knowledge of federal financing programs dedicated to supporting sustainability investments.

<u>Federal Loan Program Awareness</u>

Only 20% of respondents (n = 8) were aware of the

availability of federal loan programs for sustainable financing, including SBA green loans and USDA REAP financing available to SMBs. This indicates that 80% of interested SMBs (n = 34) are completely unaware of significant federal funding that could support their sustainability initiatives.

Cross-tabulation analysis shows that awareness is weakly associated with business size. Medium-sized SMBs (51–250 employees) reported 28.6% awareness (n = 4 of 14), compared to 14.3% (n = 4 of 28) among smaller SMBs. However, this difference did not reach statistical significance, likely due to the small sample size.

Qualitative responses further illustrate the extent of these information gaps: "I had no idea these programs existed. I'm bootstrapping our solar installation project because I thought we had to pay cash or take out a regular bank loan with a high rate." (Healthcare SMB, 31 employees). "Somebody had mentioned SBA loans, but I thought they were only for startup capital or equipment. I didn't know they could fund sustainability projects." (Agriculture SMB, 12 employees).

State and Local Program Awareness

Awareness of state and local programs was even more limited. Knowledge of Property Assessed Clean Energy (PACE) financing available in Florida was reported by only 9.5% of respondents (n = 4), suggesting that approximately 90% of SMBs that could benefit from PACE are unaware of this option.

Awareness of Green Bonds and Alternative Financing

Survey findings reveal an almost complete lack of familiarity with alternative financing options. Only one respondent indicated awareness of green bonds, and no respondents reported knowledge of online lending platforms that facilitate access to green financing for SMBs, such as Zero Circle, Lendio, or Biz2Credit.

Overall, this widespread lack of awareness points to a fundamental market failure: while substantial funding mechanisms exist, the vast majority of potential beneficiaries remain unaware of their availability.

The Disconnect Between Interest and Action

Integrating findings across survey dimensions reveals a major disconnect: while 90% of SMBs express strong interest in sustainability finance, only 2.4% (n=1) had actually submitted an application for any green financing program in the past three years. This 97.6% divide between interest and action provides a gauge for the scale of conversion failure in its current system.

Analysis of the single successful applicant's experience provides instructive contrast. At this manufacturing SMB (47 employees) a third-party consultant with expertise in federal grant applications worked on REAP funding. The business owner estimated costs of $8,500 consulting on how to go through the application process—21.25% of the $40,000 grant in final hands. Though this return may justify investment for medium sized SMBs undertaking bigger undertakings, the cost per unit also becomes unsustainable for smaller businesses, or more modest undertakings.

Comparative Analysis: South Florida versus International Data findings

South Florida survey findings align closely with international research while revealing even more severe awareness deficits in specific program categories. The International Chamber of Commerce reports that 66% of SMBs globally view complex funding processes as barriers, compared to 100% in this study(7). This suggests that SMBs may face particularly acute administrative burdens or that the South Florida sample captured experiences at the most challenging end of the spectrum.

The study's finding that only 20% of SMBs are aware of federal programs corresponds with national estimates suggesting comprehensive program awareness ranges between 15-25% across developed economies(4). However, the near-total absence of awareness regarding alternative financing mechanisms (green bonds, fintech marketplaces) appears more severe than international averages, suggesting particular opportunities for improvement in U.S. outreach and education efforts.

Application Rate Context

This study's finding that 2.4% of surveyed SMBs had applied for green finance aligns very closely with the International Chamber of Commerce's report that only 2.8% of SMBs globally have successfully applied for green finance in the past three years(7). This convergence between independent data sets reinforces confidence that application rates in the range of 2-3% provide an estimate of current SMB engagement with sustainability finance systems.

The virtual identity between interest rates (90%) and non-application rates (97.6%) documents a system failing to convert demand into action. This may represent an important barrier to achieving climate goals, particularly if similar patterns exist across broader SMB populations.

Ranking and Quantifying Barriers

Survey participants were asked to rank barriers to pursue sustainability finance in order of importance. As shown in Table 1, complicated funding processes were the most prevalent barrier (100%), followed by high upfront costs (88%) and lack of awareness of programs (81%).

Table 1 reports the proportion and number of businesses identifying each barrier to pursuing green financing.

Table 1. *Ranked Barriers to sustainability finance access among 42 surveyed South Florida SMBs, ordered by prevalence of respondent endorsement.*

Rank	Barrier	Prevalence	Number of respondents
1	Complicated funding process	100%	42
2	High upfront costs	88%	37
3	Lack of awareness of programs	81%	34
4	Time constraints	79%	33
5	Unclear eligibility criteria	74%	31
6	Limited internal expertise	71%	30
7	Long approval timelines	69%	29
8	Insufficient technical knowledge	64%	27
9	Difficulty accessing consultants	50%	21
10	Perceived low ROI	31%	13

Chi square investigation of whether the prevalence of barriers varies with small (5-50 employees) and medium (51-250 employees) businesses, indicated that there are no significant differences between the two categories of barriers, meaning these barriers are for SMBs generally, but not exclusively in segments of smaller size.

Of significance was the second highest financial barrier (upfront costs) among barriers, which had received significant policy coverage, and first was process complexity and awareness deficits. This ordering implies that access to capital is less limiting than access to the system.

Current Market Landscape and National Context

Sustainable Finance Market Growth

Analysis of secondary data confirms the sustainability finance market's remarkable expansion. Global sustainable debt issuance was $1.6 trillion in 2025 (8). In the United States, sustainable finance assets under management have grown substantially, though SMB participation remains disproportionately low compared to larger enterprises.

The renewable energy investment sector has shown particularly strong growth, with global investment reaching a record $386 billion in the first half of 2025(9). However, SMB participation in this growth has been concentrated in specific sectors and geographic regions, with significant variations in access and uptake rates.

Financial Institution Engagement

Market analysis reveals growing financial institution involvement in SMB sustainability finance. Research indicates 73% of financial institutions now offer green or sustainable finance options specifically tailored for SMBs (7). However, this supply-side availability has not translated into proportional SMB uptake, with the 2.8% application rate indicating substantial gaps between supply and demand.

Federal and State Program Assessment

Small Business Administration Green Initiatives

The SBA has implemented several significant programs to support SMB sustainability initiatives. The SBA Green Lender Initiative, launched in 2024, represents a major expansion of federal support for SMB green financing (10, 11). This program leverages SBA loan guarantees to attract private capital for clean energy investments, building on the success of previous loan guarantee programs.

The SBA 504 Green Loan Program has been particularly effective in principle, offering up to $5.5 million per project for energy-efficient and renewable energy initiatives (12, 13). The April 2024 removal of the $16.5 million aggregate cap on "green" loans significantly expanded potential access to capital for larger-scale green initiatives among SMBs.

To qualify for SBA 504 Green Loans, businesses must either reduce energy consumption by at least 10% through building upgrades or generate at least 15% renewable energy through property improvements (13). These requirements have proven technically accessible

to a wide range of SMBs while ensuring meaningful environmental impact.

However, survey findings suggest these programs' effectiveness is severely limited by awareness deficits and process complexity. Despite these programs' substantial capacity, only 20% of surveyed SMBs knew they existed, and zero survey participants had successfully secured SBA green financing.

USDA Rural Energy for America Program (REAP)

The REAP program has emerged as a significant funding source for rural SMBs pursuing renewable energy and energy efficiency projects (14, 15). The program provides both grants and loan guarantees, with renewable energy system grants ranging from $2,500 to $1 million, covering up to 50% of total eligible project costs.

Recent improvements under the Inflation Reduction Act increased maximum grant sizes and expanded eligibility criteria (16). Funding levels vary by project type. Energy efficiency improvements typically receive grants ranging from $1,500 to $500,000, while renewable energy systems may qualify for funding between $2,500 and $1,000,000. These grants directly lower upfront expenses, making sustainable investments more attainable. The program's dual focus on agricultural producers and small rural businesses has proven effective in reaching underserved markets when implemented successfully.

Department of Energy Programs

The Department of Energy has allocated significant resources to SMB green innovation through the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs (17). In 2024, DOE announced $142 million in grants to 123 small business projects across 34 states, addressing decarbonization, grid reliability, fusion energy, and other clean energy challenges.

These programs have demonstrated measurable impact, with DOE awardees reporting over $1.7 billion in sales resulting from SBIR/STTR awards (17). The focus on technological innovation and commercialization has enabled SMBs to develop and scale clean energy solutions while building sustainable business models.

However, these competitive grant programs require substantial technical expertise and proposal preparation capacity that many SMBs lack. The low awareness rate documented in the survey suggests that many potential applicants never enter the competitive pool.

Property Assessed Clean Energy (PACE) Program

PACE financing represents a unique public-private partnership available in 40 states, with over 10,000 cities, towns, and villages participating (18). Since its inception in 2008, the program has funded over $19 billion in energy efficiency projects. PACE financing offers several advantages that are particularly well suited to the needs of SMBs. These include little to no upfront capital requirements, extended repayment periods that can reach up to 30 years, and repayment structures tied to property tax assessments, which significantly reduce traditional credit barriers. Additionally, such investments can increase property values, further strengthening their financial appeal.

Despite these SMB-friendly features and Florida's participation in PACE, only 9.5% of surveyed SMBs demonstrated awareness of the program. This represents a critical missed opportunity, as PACE's structure directly addresses the upfront cost and cash flow constraints identified as primary barriers by 88% of survey respondents.

Private Sector Financing Mechanisms

Private sector involvement in SMB sustainability finance has increased significantly as some of the biggest and most successful ventures with significant commercial opportunities in green SMB lending have shown great development. Microsoft's Climate Innovation Fund (CIF) represents $1 billion in investment for climate technology development and deployment (19). While CIF targets scaling existing solutions, which may potentially limit the range of accessibility for smaller firms, its aim of increasing the availability of low-cost green technologies has a positive impact on SMBs indirectly as it helps with reducing the overall cost of these projects.

Specialty green banks and mission-driven lenders have opened up new opportunities for SMBs that are unsuitable for traditional financing. Some of these institutions offer better terms or extra technical support so that the sustainability project implementation process for the SMBs can be more easily addressed and also offer more flexibility, providing the SMBs with more technical support in order to help them overcome the intricacies of operating such schemes involving sustainability project implementations.

Recognizing the enormous complexities SMBs face with sustainability financing, several fintechs have emerged to help streamline the process. Zero Circle, a New York-based fintech, offers a green finance platform that provides SMBs with convenient access

to green loans. Their system uses third-party data and company metrics to automatically assess loan eligibility, simplifying the process for businesses seeking funds for sustainable projects. But the survey finds that despite the programs' explicit mission to simplify the process of obtaining funding, awareness of these cutting-edge solutions is virtually nil among SMBs, with zero respondents indicating awareness of Zero Circle, Lendio or Biz2Credit—the perceived barrier identified by 100% of respondents.

Success Stories: When Access Works

Several evidence-based cases illustrate that if appropriate support can be provided, the SMB engagement with sustainability finance can be successful and that this is instructive in contrast to the survey's mostly negative findings in terms of access and awareness.

International Model: Turkey Sustainable Energy Finance Facility (TurSEFF)

The TurSEFF program, implemented by the European Bank for Reconstruction and Development with $42.4 million in Climate Investment Funds support, is an example of successful SMB engagement (20). The program worked with local commercial banks that had built relationships and distribution networks with SMBs throughout Turkey. The challenge of targeting small businesses with extensive spread across the country was overcome by leveraging financial infrastructure and existing relationships.

The success of the TurSEFF program can be attributed to several key factors. These include the use of existing banking relationships to reach SMBs effectively, the implementation of simplified application processes tailored to small businesses, and the provision of technical advisory support alongside financing. In addition, risk-sharing mechanisms played an important role in encouraging lender participation and reducing perceived financial risk.

U.S. Success Case: PACE Implementation in Florida

Jackson 'Rip' Holmes, a small business owner in Coral Gables, Florida, provides a compelling example of how an SMB could overcome significant financial barriers through PACE financing. Holmes lacked $25,000 upfront costs for his sustainability project, so he partnered with Ygrene, a PACE provider, to raise funds in less than 45 days. This case illustrates PACE's particular value for SMBs facing cash constraints, although Holmes' success depended on awareness of the program—something lacking among 90.5% of surveyed SMBs.

REAP Success: Wildtype Native Plant Nursery

Bill Schneider, owner of Wildtype Native Plant Nursery near Lansing, Michigan, had doubts early on about government-funded programs. After working with a third-party sustainability consultant, Wildtype, he was able to secure REAP funding.

Some of the key outcomes included lowering monthly utility fees from $550 to $100 (82% decrease), reaching environmental targets without sacrificing profitability, generating local employment from installation work and building long-term business resilience through energy independence.

Schneider's business success came at the high cost of seeking external consulting expertise, which is part of the cost of acquiring outside counsel on how to apply for the application process, which might be too much money for smaller SMBs or those pursuing more modest applications. This reinforces survey findings about process complexity being a key access barrier.

DISCUSSION

The Virtuous Circle of Sustainability Finance

The findings of this study suggest the presence of a "virtuous circle" connecting sustainability reporting, sustainable finance access, and enhanced climate action for SMBs. This mechanism represents a practical pathway to accelerate SMB involvement in addressing climate change through three interconnected phases: widespread sustainability reporting, increased sustainable finance access, and enhanced climate action implementation.

These patterns imply that sustainability reporting and access to finance are mutually reinforcing, which in turn creates a self-reinforcing cycle that favors SMBs already able to engage with the system. This dynamic also illustrates that capabilities such as measurement, transparency, and financial readiness function not just as outcomes, but as prerequisites for continued participation in sustainability finance.

However, the extremely limited participation in the sustainability finance ecosystem suggests that systemic barriers continue to restrict wider engagement, indicating substantial untapped potential for expansion. This points to a systemic constraint, where access challenges arise from how the financing systems are structured and communicated rather than from capital scarcity.

Policy Effectiveness and Optimization

The results of this study suggest variation in the effectiveness of federal programs in reaching SMBs. The SBA Green Lender Initiative's solution, taking advantage of financial systems already in place but providing guarantees and incentives, has the potential to enhance access at scale (10). This model alleviates both traditional lenders' risk fears and SMBs' difficulty accessing capital.

The success of REAP in rural markets illustrates the critical need for the design of sector-targeted programs that consider the specific characteristics and requirements of individual SMB segments (14,15). The grants and loan guarantees model of the program provide flexibility in addressing diverse project funding needs.

However, the research also identifies considerable weaknesses in the reach and utility of the program. Complex application processes and extensive documentation requirements still prevent many smaller businesses from accessing various sustainability finance options. This indicates an urgent need for simplified application processes and more effective technical assistance systems.

Market Development and Private Sector Engagement

The growth of private sector involvement in SMB sustainability finance represents a positive development that could significantly expand available capital (8). However, this growth requires supportive policy frameworks that help align private sector risk-return expectations with the realities of SMB green investments.

The emergence of specialized "green banks" and mission-driven lenders has created new opportunities for SMBs that may not qualify for traditional financing. These institutions provide more flexible terms and additional technical assistance. As a result, both capital and knowledge barriers are addressed simultaneously.

Bank participation in sustainable SMB lending has grown substantially, with most now offering some form of green financing product. However, many banks still face challenges in assessing green project risks and returns, particularly for smaller transactions where due diligence costs may be proportionally high.

Regional and Sectoral Variations

The research provides evidence of regional and sectoral differences within the South Florida sample in access and use of sustainability finance among SMBs. Targeted initiatives such as REAP have helped a great deal with rural businesses, while urban SMBs may have a wider range of financing alternatives but have different competitive and regulatory environments.

Sectoral differences are particularly pronounced, with energy-intensive industries showing higher participation rates in efficiency upgrade programs, while service sector businesses may have different sustainability finance needs that are not fully met by current programs.

These differences point to the need for more nuanced policy approaches to the specific characteristics, challenges and opportunities faced by different segments of SMBs. The heterogeneous needs of the SMB community may not lend themselves to one-size-fits-all approaches.

Technology and Digital Solutions

The research shows the importance of digital solutions in overcoming the access barriers to sustainability finance. SMBs that use digital sustainability reporting tools show substantially higher success rates in accessing finance and implementing formal sustainability processes. Technology solutions may help address multiple core barriers identified in this study at the same time and in a consistent manner, among them: simplifying administrative burdens, enhancing data quality and standardization, and presenting decision-support solutions that facilitate SMBs to explore and assess sustainability investment opportunities.

Nevertheless, technology-based solutions do face limitations in this regard among some SMB segments, including small businesses in rural areas or those whose industries are traditional sectors with limited technological capabilities or resources.

Future Opportunities and Scaling Potential

The findings reveal opportunities to expand SMB access to sustainability financing through focused interventions. The emergence of a potential $789 billion green finance opportunity for SMBs worldwide presents a clear representation of the magnitude of the untapped opportunity in this market. Opportunities for growth include streamlining the applications process, strengthening technical assistance programs, offering sector-specific financing products and increasing synergy between the various funding sources and programs.

The study also found opportunities to use technology to lower transaction costs and increase program accessibility. There is potential for international cooperation and knowledge transfer to facilitate development and implementation, particularly leveraging what works in other countries to the U.S. market and regulatory environment.

Limitations

This research recognizes a number of limitations:

Sample size and generalizability: The sample size of 42 SMBs, while rich in empirical context, limits statistical power for detecting small effect sizes and restricts generalizability to the broader U.S. SMB population. Results should be understood as a reflection of trends where more general studies will be needed to test these.

Regional specificity: The focus on South Florida adds depth, but may not adequately reflect the experiences of SMBs in regions with varied economies, regulations, or climate vulnerabilities.

Self-selection bias: Voluntary participation can induce bias when SMBs who seem to have more relevant characteristics (e.g. greater sustainability interest or experience with financing) are recruited to participate.

Data availability: The uptake of SMB green finance remains sparse due to the early stage of many new programs and reporting inconsistencies across funding mechanisms.

The study responds to these limitations through triangulation of various sources, an explicit recognition of uncertainty and careful qualification of claims by reference to evidence.

CONCLUSION

The study indicates that a major challenge for SMBs in accessing sustainability finance is not a lack of available funding but rather the difficulty in navigating and accessing that funding. While SMBs show strong interest in sustainability initiatives, structural and informational barriers continue to limit participation.

It is evident that just increasing funding or expanding financial programs may not be enough to drive meaningful change. Better processes for designing, communicating, and delivering these programs will very likely have a greater effect on participation. Practical improvements should focus on simplifying procedures, raising awareness, and strengthening SMBs' knowledge and assistance in sustainability finance.

Making the transition to a sustainable economy will require the active engagement of SMBs in the U.S. This research shows that there is potential to unlock green innovation for SMBs through targeted sustainable finance initiatives. Success in this endeavor will also further national climate goals and bolster the competitiveness and resilience of the SMB sector in America.

Given that 100% of surveyed SMBs identified complex funding processes as a primary barrier, along with 76% citing documentation requirements and 67% citing application process complexities, simplifying administrative procedures should be a top policy priority. To streamline application processes, federal agencies can develop a unified portal for SMB sustainability finance programs. Ideally, this would be similar to FAFSA or SBA's general loan platforms. In addition to that, standardizing eligibility criteria and reporting requirements across agencies would further reduce administrative complexity.

Expanding technical assistance by creating regional advisory hubs to help SMBs identify funding opportunities and prepare applications would be extremely impactful. This can also be improved by building partnerships with local chambers of commerce and industry associations to provide training on reporting and compliance.

Financial institutions underwriting small-scale green loans can be offered more risk-sharing incentives to improve participation rates. The SBA Green Lender Initiative could also be expanded to incorporate interest rate subsidies in addition to traditional loan guarantees to address the barrier associated with high upfront costs.

Supporting fintech platforms such as Zero Circle, Lendio and Biz2Credit that automate eligibility checks and sustainability reporting could significantly improve the funding application process for SMBs. Providing grants or subsidies for SMBs to adopt digital sustainability reporting tools could further help with reducing administrative burdens.

Sector and region-specific interventions should be a key strategy to help improve awareness of federal funding programs. Financing products should be tailored to industries with unique needs, such as restaurants, manufacturers and service providers. REAP-like models should be expanded to serve urban SMBs in addition to serving only rural/agricultural sectors. Additionally, accelerating the availability of PACE to all the states in the United States would increase access to capital for energy-efficiency projects. Governments should invest in targeted outreach campaigns and partnerships with local business networks to improve visibility for these financing programs.

The study's comparative analysis shows that SMBs face similar barriers, though awareness gaps in this sample are particularly severe. Encouraging international learning and adopting best practices can be highly beneficial. Lessons from initiatives such as TurSEFF in Turkey and the EU SMB Green Deal financing programs

could be studied, tailored and implemented to meet the needs of the U.S. market. Promoting cross-country knowledge sharing would also help to optimize U.S. program design. It would also be valuable to incentivize nonprofits such as the SMB Climate Hub to help SMBs understand the business value of sustainability initiatives and the various low-cost financing options available to them.

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CONFLICT OF INTEREST

The author declares that there are no conflicts of interest regarding the publication of this article.

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