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Growth through Green? Evidence from Firms Adopting Resource Efficiency Practices

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ABSTRACT: *This study examines the relationship between the adoption of resource-efficiency practices and firm growth, measured in terms of employment and turnover. Drawing on survey data from Flash Eurobarometer 549, considering 10,994 firms, we analyze both the cumulative implementation of ten distinct resource-efficiency actions and the individual impact of each practice. Our results show that the breadth of implementation does not have a significant effect on firm growth, suggesting that merely increasing the number of adopted practices is insufficient to drive performance. However, specific practices, such as internal recycling and switching to greener suppliers, are associated with positive growth outcomes, while others, including waste minimization and external waste sales, exhibit negative or mixed effects. These findings contribute to the literature on corporate sustainability by highlighting the heterogeneous impact of environmental actions and emphasizing the importance of strategic alignment in achieving sustainable growth. Implications for firm-level decision-making and policy design are discussed.*

Key words*: Corporate sustainability, employee growth, firm growth, resource efficiency practices, turnover growth.*

1. Introduction

Firm growth—which may be considered in terms of increased employment and higher turnover (Gruenwald , 2015)—remains a central objective for firms as well as an indicator of economic vitality and competitiveness at both the micro and macroeconomic levels (Ghoshal et al., 1999; Delmar et al., 2003). As firms expand, they contribute to job creation, innovation, and regional development, making the determinants of such growth a critical topic for researchers and policymakers alike. With this in mind, prior research has devoted increasing attention to the antecedent of firm growth (Penrose, 2009), including firm characteristics (e.g., age and size) (Variyam & Kraybill, 1992), learning mechanisms (Macpherson & Holt, 2007), access to financing (Rahaman, 2011), organizational features and the external competitive environment (Bini et al., 2023).

More recently, it has been acknowledged firm growth is especially important in an era of shifting economic paradigms, where sustainability considerations are becoming increasingly intertwined with competitiveness. In this context, firms are increasingly adopting resource-efficiency practices to reduce environmental impacts and optimize the use of inputs such as energy, water, and raw materials (Sardana et al., 2020; Ardito, 2023). In turn, tooted in the seminal question of whether going green pays off (Porter, 1995; Ambec & Lanoie, 2008), there has been a growing interest in the intersection between corporate sustainability

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practices and economic/operational performance (Nogueira et al., 2023). Despite this, the empirical literature on the relationship between resource-efficiency implementation and firm growth remains limited, focusing on sustainability orientation instead of actual implementation of resource efficiency practices (e.g., Chistov et al., 2023), green capabilities (Yi & Demirel, 2023), or isolated practices employed by firms in specific contexts (Kabbera et al., 2024), providing an incomplete picture of how specific resource efficiency actions influence firm growth. Relatedly, the breadth of possible resource efficiency actions—where multiple measures can be implemented concurrently—complicates the task of disentangling the cumulative effects from the impact of individual initiatives. This limits the ability to draw clear, practical recommendations for firms aiming to invest in sustainability in a strategic and targeted manner.

This paper aims to fill these gaps by empirically examining the relationship between firms' implementation of resource-efficiency actions and their subsequent growth. We consider a comprehensive set of ten resource-efficiency practices, analyzing their combined and individual effects to better understand which strategies are most conducive to growth. By doing so, we seek to provide more nuanced insights into how environmentally sustainable behaviors can align with firms' economic objectives, moving beyond generic sustainability rhetoric toward an evidence-based understanding of what works in practice.

Our analysis draws on survey data from Flash Eurobarometer 549, considering 10,994 firms, capturing self-reported information on resource-efficiency practices, organizational characteristics, and performance outcomes. We model firm growth using two dependent variables—growth in the number of employees and growth in turnover—while controlling for a range of firm-level factors, including size, age, investment levels, and external barriers to environmental action. We distinguish between the aggregate number of resource-efficiency practices adopted (as a measure of implementation breadth) and the specific impact of each individual practice through dummy variables.

The results reveal that the implementation of multiple resource efficiency practices simultaneously does not exert a significant effect on either form of firm growth, suggesting that simply implementing more practices is not sufficient to drive performance gains. When examining individual practices, we find that some of them—such as internal recycling and switching to greener suppliers—are associated with positive outcomes, while others—such as waste minimization or selling waste—may have unintended negative effects. Other practices demonstrate no observable effect. These findings highlight the heterogeneity in the impacts of resource efficinecy practices and underscore the need for a targeted, context-sensitive approach to sustainability strategy.

The implications of our study are both theoretical and practical. Conceptually, our findings challenge the notion that going green automatically supports firm growth and call for a more nuanced understanding rooted in strategic fit, implementation quality, and sectoral context. For practitioners, the results suggest that not all green actions are equally beneficial and that firms must carefully evaluate which practices are most aligned with their operational models and market conditions. For policymakers, the findings support the design of more differentiated support mechanisms that promote high-impact practices and mitigate the transition costs of others.

2. Theoretical background

Firm growth is a central topic in the fields of strategic management, entrepreneurship, and industrial organization, often considered both a goal and a measure of success for business enterprises (Ghoshal et al., 1999; Delmar et al., 2003). Understanding the antecedents of firm growth is critical not only for scholars but also for policymakers and practitioners seeking to foster economic development and competitiveness (OECD, 2021; Bradley et al., 2022). The literature identifies a diverse array of growth determinants, which can be broadly categorized into firm-specific, entrepreneur-related, and external environmental factors.

Firm-specific antecedents encompass internal resources and capabilities that enable firms to scale operations and compete effectively (Nason & Wiklund, 2018). Resource-based theory posits that the possession and strategic deployment of valuable, rare, inimitable, and non-substitutable (VRIN) resources are central to firm growth (Barney, 1991). Tangible resources such as capital and technology, alongside intangible assets like intellectual property, brand equity, and organizational culture, significantly influence growth trajectories (e.g., Andrews &. de Serres, 2012; Yang et al., 2015). Moreover, dynamic capabilities—defined as a firm's ability to integrate, build, and reconfigure internal and external competencies in response to

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environmental change (Teece et al., 1997)—have emerged as critical enablers of sustained growth in volatile markets.

Entrepreneurial and managerial antecedents focus on the characteristics, behaviors, and strategic orientations of firm leaders (Aragón-Sánchez & Sánchez-Marin, 2005; Harms, 2009). Empirical studies consistently highlight the importance of the entrepreneur's human capital, including prior industry experience, education, and social networks, as predictors of firm growth (Colombo & Grilli, 2005). Entrepreneurial orientation, encompassing innovativeness, risk-taking, and proactiveness (Lumpkin & Dess, 1996), has also been linked to higher growth outcomes. Leadership style, decision-making processes, and the ability to cultivate organizational learning further contribute to growth performance, particularly in small and medium-sized enterprises (SMEs).

External antecedents include the broader institutional and market context in which firms operate. Industry growth rate, competitive intensity, access to financial markets, technological infrastructure, and regulatory environments all shape growth potential (Cetorelli & Gambera, 2001; Svaleryd & Vlachos, 2005; Babar & Habib, 2021). Firms embedded in supportive ecosystems—such as clusters, innovation hubs, or international value chains—often benefit from knowledge spillovers, collaboration opportunities, and scale economies that facilitate expansion (Mason & Brown, 2014; Zhang et al., 2024).

In summary, firm growth is shaped by a complex interplay of internal competencies, entrepreneurial agency, and external conditions. In this context, recent contributions to the literature increasingly highlight the importance of implementing resource efficiency practices alongside broader sustainability efforts, as key drivers of firm growth (e.g., Chistov et al., 2023). However, a full understanding of the role of resource efficiency practices remains limited, especially considering their heterogeneous nature and the fact that such practices are not necessarily complementary or uniformly effective across different contexts.

2.1. Firm Growth and Resource Efficiency Practices

Building on the multidimensional understanding of firm growth, this study narrows its focus to investigate resource efficiency practices as a distinct and increasingly relevant category of antecedents (Chistov et al., 2023). While traditional research has emphasized financial capital, innovation, and managerial capabilities, there is a growing recognition that how firms manage and optimize their resource use—particularly in the context of environmental sustainability—can significantly influence their growth trajectories.

Resource efficiency, broadly defined as the strategic utilization of inputs such as energy, water, materials, and labor to maximize output while minimizing waste and environmental impact (van Ewijk, 2018), is gaining prominence as both a competitive advantage and a driver of long-term value creation. This perspective aligns with the emerging literature on the circular economy, eco-innovation, and sustainable operations, which suggests that firms adopting such practices not only reduce operational costs but also enhance resilience, regulatory compliance, and market appeal (Horbach et al., 2012; Bocken et al., 2016).

Importantly, the implementation of resource efficiency practices may contribute to firm growth through several mechanisms, such as reducing input costs and waste disposal expenses, attracting stakeholders—customers, investors, and partners—who prioritize sustainability, complying with environmental standards, and accessing to green financing instruments (Dahmus, 2014; Kilpeläinen, et al., 2019; Xu et al., 2023).

However, the relationship between resource efficiency and firm growth is not uniformly positive. Implementing resource efficiency practices often requires initial investments, process redesign, and new capabilities, which can be particularly challenging for small and resource-constrained firms (Hu et al., 2024). Additionally, the growth impact of such practices may be more pronounced in the medium to long term, as the benefits accrue over time and depend on the firm's ability to integrate these practices into its broader strategic orientation (Kirikkaleli & Ali,(2024).

By exploring specific practices in the following, we aim to provide a nuanced understanding of how firms can leverage operational sustainability to drive expansion, profitability, and competitiveness in a resource-constrained global economy.

2.1.1. Saving Water

Saving water as a resource efficiency practice involves the implementation of strategies and technologies aimed at reducing water usage, optimizing water recycling, and minimizing waste within a firm's operations. This practice can enhance a company's cost efficiency by lowering water bills and reducing the need for

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water-intensive processes. By adopting water conservation methods, firms can also improve their sustainability profile, potentially attracting eco-conscious customers, investors, and partners. However, the initial investment in water-saving technologies or system modifications can be expensive and may pose a financial burden, particularly for small businesses. Despite this, over time, water-saving practices often lead to long-term cost reductions, operational efficiencies, and a stronger reputation, which can foster growth. On the other hand, without proper planning or if water conservation measures are not aligned with business goals, the transition could temporarily hinder productivity and growth due to the required upfront costs and changes in operations.

2.1.2. Saving Energy

Saving energy as a resource efficiency practice involves reducing energy consumption by optimizing processes, using energy-efficient technologies, and promoting sustainable energy sources within a firm's operations (De Groot et al., 2001; Caporale et al., 2023). This practice can lead to significant cost savings on energy bills, improve operational efficiency, and help firms comply with environmental regulations and sustainability goals (Zhang et al., 2022a). By adopting energy-saving strategies, firms can also enhance their reputation as environmentally responsible, which may attract customers, investors, and talent who value sustainability (Zhang et al., 2022b). However, the initial investment in energy-efficient infrastructure, such as LED lighting or upgraded machinery may be costly and could strain the financial resources, especially for smaller firms, let alone the risk of rebound effects (Berner et al., 2022). Eventually, in the long term, energy savings, reduced operational costs, and potential tax incentives can contribute to a firm's profitability and competitive advantage, driving growth. On the flip side, if not well-executed, such measures could temporarily disrupt operations and reduce productivity, especially during the transition phase.

2.1.3. Using Predominantly Renewable Energy

Using predominantly renewable energy, such as generating electricity through solar panels or sourcing energy from wind or hydroelectric systems, is a resource efficiency practice where firms shift away from traditional, non-renewable energy sources to more sustainable options (zhang et al., 2022c). This practice helps reduce a firm's carbon footprint, minimize reliance on fossil fuels, and potentially lower energy costs over time. Firms that invest in renewable energy infrastructure can also gain a competitive edge by promoting their commitment to sustainability, appealing to environmentally-conscious consumers and partners (Deshmukh et al., 2023). However, the initial setup costs for renewable energy systems, like installing solar panels or wind turbines, can be substantial, which may pose a financial challenge, particularly for smaller companies or those with limited capital (Kempa et al., 2021). While these investments can result in long-term savings and energy independence, firms may face a slower return on investment in the short term, potentially limiting immediate growth. Despite this, businesses that integrate renewable energy into their operations can position themselves as forward-thinking, resilient, and adaptable to future energy market shifts, which could ultimately foster long-term growth.

2.1.4. Saving Materials

Saving materials as a resource efficiency practice involves minimizing the use of raw materials, reducing waste, and optimizing the production process to avoid overuse of resources (Lodenius et al., 2009). By reducing material consumption, firms can lower production costs, reduce waste disposal fees, and enhance their environmental impact; additionally, this practice can promote sustainability and create a positive brand image, appealing to eco-conscious consumers and investors (Schröter et al., 2012; Woo et al., 2014). However, there may be initial costs involved in redesigning processes or sourcing more sustainable materials, which could pose a challenge for firms with limited budgets (Kalar et al., 2021). While these upfront expenses may slow short-term growth, the long-term benefits of material savings—such as reduced costs, higher efficiency, and fewer supply chain disruptions—can support sustained growth and profitability. Furthermore, adopting such practices can help firms become more resilient to material price fluctuations and supply chain constraints.

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2.1.5. Switching to Greener Suppliers of Materials

Shifting to greener material suppliers can offer firms both strategic advantages and practical challenges. On the positive side, aligning with environmentally responsible partners enhances a company's reputation, attracting talent—particularly younger, sustainability-minded employees—and boosting morale among existing staff who value purpose-driven work (Andersén, 2021; Cheng-Wen, 2008). This can support long-term employee growth through increased engagement, retention, and opportunities in sustainability-related roles. For the business itself, green suppliers can unlock access to eco-conscious markets, support compliance with environmental regulations, and improve customer loyalty. These factors often translate into stronger brand positioning and revenue growth over time. However, the transition can also hinder growth, especially in the short term. Sustainable materials often come at a higher cost, which may constrain budgets for hiring or staff development. Operational disruptions during supplier changes can lead to inefficiencies or staff resistance, particularly if processes need to be overhauled (Runtuk et al., 2024). Likewise, the increased costs may temporarily impact profit margins and slow turnover growth if not balanced with pricing strategies or customer demand.

In sum, switching to greener suppliers is a forward-thinking move, but one that requires careful planning to ensure it supports—rather than stalls—both employee and financial growth.

2.1.6. Minimisng Waste

Minimising waste as a resource efficiency practice involves not only reducing physical by-products and inefficiencies but also rethinking how waste is defined and managed across a firm's value chain. Rather than viewing waste solely as something to dispose of, forward-thinking firms increasingly treat it as a potential resource—one that can be repurposed, sold, or transformed into new value streams through circular economy models (McDougall et al., 2022; Rasanjali et al., 2024). For instance, excess heat from manufacturing can be captured and reused, or discarded materials can become inputs for new products (Zhang et al., 2016). This shift in mindset can spark innovation and create new revenue channels, while also reducing disposal costs and environmental impact. However, implementing such systems often requires cultural change, cross-departmental coordination, and new technologies, which can be resource-intensive in the short term. If poorly executed, waste minimisation efforts might disrupt operations or divert focus from core business activities (McGrath, 2001). Yet, when done strategically, it positions firms as leaders in sustainability and operational efficiency, supporting long-term, resilient growth.

2.1.7. Selling Your Residues and Waste to Another Company

Selling residues and waste to another company—an approach often associated with industrial symbiosis—is a resource efficiency practice that transforms what was once considered a cost burden into a potential revenue stream (Neves et al., 2020). Instead of disposing of by-products, firms can create value by supplying them to other businesses that use these materials as inputs, such as a food processor selling organic waste to a biogas facility or a metal manufacturer supplying scrap to a recycling firm. This practice not only reduces waste management costs and landfill use but also fosters collaborative networks that can increase resilience and innovation across industries (Yuan & Shi, 2009). A lesser-discussed advantage is the potential for firms to gain insights into other sectors' needs, sparking opportunities for diversification or co-development (Herczeg et al., 2018). However, challenges include the need to ensure consistent waste quality, manage logistics, and navigate regulatory frameworks. If market demand for certain residues is unstable, reliance on these partnerships may introduce risk (Golev et al., 2015). Still, with growing interest in circular economy models, industrial symbiosis can support sustainable growth by turning environmental challenges into strategic business opportunities.

2.1.8. Internal recycling

Recycling by reusing material or waste within the company—often referred to as internal recycling—is a resource efficiency practice where firms reintegrate scrap, offcuts, or by-products back into production processes instead of discarding them (Pagell et al., 2007; Alves et al., 2015). This closed-loop approach reduces dependency on external raw materials, cuts waste disposal costs, and can improve operational resilience against price volatility or supply disruptions. A novel insight lies in how internal recycling can drive process innovation; engineering teams may redesign products or machinery to better accommodate reused

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materials, leading to leaner, more adaptive production models (Mazzucchelli et al., 2022; Mbago et al., 2025). While this can improve margins and contribute to turnover growth by reducing input costs, it doesn't always translate to proportional employee growth. In fact, increased efficiency may reduce the need for certain manual roles, potentially limiting job creation or even leading to workforce restructuring. On the other hand, if recycling initiatives spur new product lines or require specialized skills—like quality control for reused inputs—they may open up new employment opportunities. Thus, internal recycling supports firm growth, but its impact on turnover and staffing depends heavily on how it's integrated into the broader business strategy.

2.1.9. Designing Products That are Easier to Maintain, Repair or Reuse

Designing products that are easier to maintain, repair, or reuse is a forward-looking resource efficiency practice that shifts value creation from volume-based sales to longevity and lifecycle services (Sinioros et al., 2020; Bayraktaroğlu & İdemen, 2024). This approach—central to circular design—reduces material consumption over time, fosters customer loyalty, and aligns with rising regulatory and consumer demand for sustainable, right-to-repair-friendly products. An often-overlooked benefit is the potential for new service-based revenue streams, such as maintenance packages, refurbishment services, or part replacement programs (Mohammadian et al., 2025; Roskladka et al., 2025), which can drive turnover growth even if unit sales decline. In terms of employment, this model may encourage growth in skilled labor areas like repair, customer service, and reverse logistics, potentially offsetting reduced demand for manufacturing new units. However, this transition can challenge firms accustomed to linear, high-turnover business models; profits may be delayed, and retraining or restructuring may be required to support new capabilities (Jaeger et al., 2020). Overall, while this design strategy may slow short-term growth in product sales, it can build long-term value, customer retention, and employment in service-oriented roles, fostering a more resilient and diversified growth trajectory.

3. Methods and Data

The empirical analysis is based on data from Flash Eurobarometer 549, a specialized survey titled *SMEs, Resource Efficiency and Green Markets* (European Commission, 2025). It was conducted by Ipsos European Public affairs at the request of Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. Survey co-ordinated by the European Commission, Directorate-General for Communication (DG COMM "Media monitoring and Eurobarometer" Unit). The Flash Eurobarometer 549 survey was conducted across the 27 Member States of the European Union, along with additional countries including Albania, Iceland, North Macedonia (FYROM), Moldova, Montenegro, Norway, Serbia, Switzerland, Turkey, the United Kingdom, and the United States. It focused on businesses employing at least one individual, spanning a broad range of sectors as categorized by the NACE classification codes. These sectors encompass activities such as mining and quarrying (Section B), manufacturing (Section C), and utilities including electricity, gas, steam, and air conditioning supply (Section D). Additionally, the survey covers water supply, sewerage, waste management, and remediation activities (Section E), as well as construction (Section F). The wholesale and retail trade, including the repair of motor vehicles and motorcycles, is also included (Section G), along with transportation and storage (Section H). The survey extends to businesses involved in accommodation and food service activities (Section I), information and communication (Section J), and financial and insurance activities (Section K). Real estate activities (Section L) and professional, scientific, and technical activities (Section M) are also part of the survey's scope. This extensive coverage enables a wide-ranging analysis of business practices across various industries, providing valuable insights into the challenges and opportunities faced by firms in different sectors, particularly in areas such as innovation, sustainability, and digital transformation.

Flash Eurobarometer surveys, which have been periodically launched since the late 1980s, undergo rigorous pilot testing and are typically conducted via telephone interviews. This mode of data collection minimizes respondent misinterpretation, thereby enhancing the reliability, validity, and clarity of responses. Due to these methodological strengths, previous studies have relied on similar Flash Eurobarometer datasets (e.g., Hoogendoorn et al., 2019; Ardito, 2023), as well as on comparable large-scale surveys such as the Community Innovation Survey by Eurostat (e.g., Blindenbach-Driessen & van den Ende, 2014).

The data from the Flash Eurobarometer 549 survey reveals a comprehensive overview of resource efficiency practices and sustainability efforts across firms in various sectors. Companies were asked to report on actions they have taken regarding resource efficiency, such as water and energy conservation, the use of

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renewable energy, material savings, switching to greener suppliers, waste minimization, selling residues, internal recycling, and designing products for easier maintenance or reuse. Additionally, firms were surveyed on their performance, including firm growth.

After checking for missing values, we considered 10,994 surveyed firms for the analysis.

3.1. Variables

Firm growth is the dependent variable of the study. Specifically, it has been distinguished in firm growth in terms of number of employees (*EmployeeGrowth*) and turnover (*TurnoverGrowth*). Both variables are ordinary variables ranging from 0 (decreased) to 3 (increased 10% or more, annually).

As independent variables, we examined both the total number of resource efficiency practices implemented by firms and the specific impact of each individual practice. The survey identified ten distinct resource efficiency practices, namely: saving water (*d_SavingWater*), saving energy (*d_SavingEnergy*), using predominantly renewable energy (including self-production through solar panels) (*d_RenewableEnergy*), saving materials (*d_SavingMaterials*), switching to greener suppliers of materials (*d_GreenerSuppliers*), minimising waste (*d_MinimisingWaste*), selling residues and waste to other companies (*d_SellingWaste*), recycling (by reusing materials or waste within the company) (*d_Recycling*), designing products that are easier to maintain, repair, or reuse (*d_Design*), other (*d_Other*). To assess the adoption of these practices, we created ten dummy variables, each corresponding to and named after one of the resource efficiency practices. A dummy variable was assigned a value of 1 if a particular practice had been implemented by the firm, and 0 otherwise. These dummy variables were included as independent variables to assess the individual effect of each practice on firm growth. Additionally, we computed the sum of these dummy variables to generate a composite measure of the breadth of resource efficiency implementation, reflecting the overall extent to which firms have adopted such practices (*ResEfficiencyBreadth*).

A set of control variables was added to improve the reliability of the model. First, we included the number of difficulties when trying to set up resource efficiency actions (*ResEfficiencyDifficulties*) among complexity of administrative or legal procedures, difficulty to adapt environmental legislation to your company, technical requirements of the legislation not being up to date, difficulty in choosing the right resource efficiency actions for your company, cost of environmental actions, lack of specific environmental expertise, lack of supply of required materials, parts, products or services, lack of demand for resource efficient products or services, complexity associated with environmental labelling and certification, complex environmental reporting requirements, other. Second, we included the number of employees when the questionnaire was distributed (*Employees*). Third, we considered the extent to which hiring qualified staff was difficult (*HiringDifficulties*) as a categorical variable (from very difficult to not relevant). Fourth, a categorical variable describing a firm founding year (before 1 January 2016, between 1 January 2016 and 31 December 2018, between 1 January 2019 and 1 January 2023, after 1 January 2023) was added (*FirmAge*). Fifth, a categorical variable indicating the firm turnover in 2023 was included (*Turnover*). Sixth, a dummy variable indicating whether the firm sells green prodcus is included (d_*GreenProduct*). Seventh, we added a dummy variable stating if a firm is or is involved in planning to become climate neutral (*d_ClimateNeutral*). Finally, Sixth, we included a categorical variable indicating the level of investment in resource efficiency actions (*ResEfficiencyInvestments*) (less than 1% of annual turnover, 1–5% of annual turnover, 6–10% of annual turnover, 11–30% of annual turnover, more than 30% of annual turnover).

4. Results

Table 1 shows descriptive statistics and pairwise correlations. Correlation values are all below 0.70, suggesting that multicollinearity issues are unlikely.

Considering the categorical nature of our dependent variable, we used ordered logistic regressions to conduct the analysis (Harrel & Harrel, 2015). Table 2 reveals the impact of *ResEfficiencyBreadth* on *EmployeeGrowth* (Model 1) and on *TurnoverGrowth* (Model 2). Model 1 and Model 2 show that *ResEfficiencyBreadth* has not univocal effect on firm growth, as in it assumes non-significant values.

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Table 1. Descriptive statistics and pairwise correlations.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1-EmployeeGrowth	1																				
2-TurnoverGrowth	.35*	1																			
3-ResEfficiencyBreadth	.02*	.03*	1																		
4-d_SavingWater	-.01	.00	.54*	1																	
5-d_SavingEnergy	-.00	.02*	.50*	.30*	1																
6-d_RenewableEnergy	.04*	.03*	.39*	.07*	.14*	1															
7-d_SavingMaterials	.00	.00	.56*	.27*	.22*	.07*	1														
8-d_GreenerSuppliers	.03*	.04*	.54*	.19*	.16*	.15*	.21*	1													
9-d_MinimisingWaste	.00	.00	.56*	.24*	.20*	.09*	.29*	.23*	1												
10-d_SellingWaste	-.00	.03*	.409*	.07*	.07*	.10*	.11*	.10*	.13*	1											
11-d_Recycling	.04*	.00	.44*	.09*	.06*	.07*	.13*	.15*	.16*	.09*	1										
12-d_Design	.01	.02*	.48*	.12*	.11*	.08*	.19*	.19*	.17*	.11*	.16*	1									
13-d_Other	.01	-.00	-.022*	-.03*	-.04*	-.01	-.04*	-.03*	-.04*	-.03*	-.00	-.03*	1								
14-ResEfficiencyDifficulties	-.01	.03*	.34*	.19*	.17*	.08*	.21*	.18*	.19*	.17*	.13*	.19*	-.03*	1							
15-Employees	.13*	.10*	.18*	.03*	.08*	.19*	.04*	.11*	.07*	.18*	.06*	.02*	.00	.09*	1						
16-HiringDifficulties	-.17*	-.10*	-.07*	-.02*	-.00	-.04*	-.01	-.02*	-.02*	-.11*	-.01*	-.03*	-.00	-.13*	-.21*	1					
17-FirmAge	.0*	.0*	-.04*	-.01	-.04*	-.05*	-.00	-.00	-.01	-.07*	.01	.01	.02*	-.04*	-.13*	.03*	1				
18-Turnover	.11*	.16*	.21*	.02*	.11*	.20*	.06*	.13*	.12*	.19*	.07*	.05*	-.02*	.14*	.48*	-.22*	-.19*	1			
19-d_GreenProduct	.03*	.02*	.18*	.03*	.06*	.11*	.07*	.18*	.08*	.04*	.11*	.12*	-.00	.08*	.05*	-.03*	.00	.09*	1		
20-d_ClimateNeutral	.05*	.01*	.19*	.04*	.08*	.17*	.06*	.15*	.08*	.06*	.09*	.08*	.01	.06*	.18*	-.04*	-.02*	.14*	.18*	1	
21-ResEfficiencyInvestments	.06*	.0*	.21*	.10*	.09*	.17*	.08*	.13*	.07*	.09*	.08*	.13*	.00	.12*	.10*	-.10*	-.01	.08*	.10*	.15*	1
Mean	1.37	1.62	4.46	.51	.71	.29	.63	.40	.71	.35	.50	.31	.00	2.61	1.92	2.16	1.28	5.51	.35	.30	2.58
Std.	.98	1.12	2.12	.49	.45	.45	.48	.49	.45	.47	.49	.46	.09	2.57	.95	1.14	.67	2.08	.47	.46	1.18
Min	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1
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Table 2. Results considering ResEfficiancyBreadth

	Model 1 DV: EmployeeGrowth		Model 2 DV: TurnoverGrowth	
	coeff.	s.e.	coeff.	s.e.
ResEfficiencyBreadth	-.009	.009	-.012	.009
ResEfficiencyDifficulties	-.031***	.007	-.001	.007
Employees	.139***	.023	.041*	.022
HiringDifficulties				
2	.377***	.047	.129**	.043
3	.361***	.059	.023	.055
4	-.932***	.046	-.384***	.050
FirmAge				
2	.518***	.067	.397***	.072
3	.584***	.064	.604***	.066
4	.571***	.128	.0284834	.141
Turnover				
2	.250***	.090	.393***	.099
3	.171**	.086	.499***	.098
4	.250***	.083	.533***	.091
5	.218**	.086	.482***	.091
6	.240***	.080	.739***	.085
7	.259***	.083	.970***	.088
8	.317***	.096	.964***	.097
9	.200	.122	1.018***	.119
d_GreenProduct	.063*	.038	.023	.037
d_ClimateNeutral	.069*	.040	-.066*	.039
ResEfficiencyInvestments				
2	.029	.050	.238***	.051
3	.048	.048	.266***	.049
4	.208***	.066	.464***	.067
5	.195*	.099	.444***	.095
6	.169	.124	.374***	.140
Wald Chi (2)	1486.20***		631.84***	
Log pseudolikelihood	-13642.81		-14544.04	

Table 3 reveals the impact of each resource afficieny practice on *EmployeeGrowth* (Model 1) and on *TurnoverGrowth* (Model 2). Model 1 shows that selling residues and wate to other firms is negatively related to *EmployeeGrowth* (b=-.182, p<0.01), while recycling is positively related to *EmployeeGrowth* (b=.107, p<0.01). All other resource efficiency practices have non-significant values. Model2 shows that switching to green suppliers of materials is positively related to *TurnoverGrowth* (b=.068, p<0.10), while minimizing waste (b=-0.098, p<0.05) and recycling (b=-.067, p<0.10) are negatively related to *TurnoverGrowth.* All other resource efficiency practices have non-significant values.

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Table 3. Results considering each resource efficiency practice

	Model 1 DV: EmployeeGrowth		Model 2 DV: TurnoverGrowth	
	coeff.	s.e.	coeff.	s.e.
d_SavingWater	-.060	.038	.009	.037
d_SavingEnergy	-.014	.041	.031	.041
d_RenewableEnergy	.037	.040	-.053	.039
d_SavingMaterials	.021	.039	-.042	.038
d_GreenerSuppliers	.048	.038	.068*	.038
d_MinimisingWaste	-.032	.041	-.098**	.042
d_SellingWaste	-.182***	.040	-.013	.038
d_Recycling	.107***	.036	-.067*	.035
d_Design	-.033	.040	.043	.039
d_Other	.135	.162	-.065	.190
ResEfficiencyDifficulties	-.028***	.007	-.002	.007
Employees	.142***	.023	.042	.022
HiringDifficulties				
2	.371***	.047	.129***	.043
3	.346***	.059	.023	.055
4	-.947***	.047	-.384***	.051
FirmAge				
2	.503***	.067	.396***	.072
3	.570***	.065	.603***	.066
4	.559***	.128	.033	.142
Turnover				
2	.247***	.090	.398***	.099
3	.165*	.087	.504***	.098
4	.241***	.083	.541***	.091
5	.214**	.086	.492***	.091
6	.242***	.080	.748***	.085
7	.268***	.084	.981***	.088
8	.330***	.096	.975***	.098
9	.200	.122	1.030***	.120
d_GreenProduct	.047	.038	.018	.037
d_ClimateNeutral	.056	.041	-.066*	.039
ResEfficiencyInvestments				
2	.0282057	.050	.238***	.051
3	.0479762	.048	.261***	.050
4	.2090078***	.067	.458***	.067
5	.1915766*	.100	.441***	.095
6	.1549585	.123	.364***	.139
Wald Chi(2)	1527.24***		648.00***	
Log pseudolikelihood	-13624.99		-14536.62	

5. Discussion

This study examined the relationship between resource efficiency practices and firm growth, using both a composite measure of practice adoption and a disaggregated analysis of ten specific practices. The findings suggest that the adoption of a broad range of resource efficiency practices does not have a statistically significant association with either employee or turnover growth. This implies that breadth alone is an insufficient condition for promoting firm growth. It may be that the scope of implementation is too superficial or that the benefits of certain practices offset the costs of others, leading to a neutral net effect. Furthermore,

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the time horizon for the realization of benefits from environmental strategies might exceed the study's cross-sectional temporal frame.

When examining individual practices, more differentiated patterns emerge. Recycling within the firm is positively related to employee growth. In contrast, selling waste to other firms is negatively associated with employee growth, possibly indicating that this practice reflects process efficiency or automation, reducing labor needs. These results emphasize the importance of distinguishing between resource efficiency strategies that generate internal capabilities and those that represent external optimization or outsourcing. In terms of turnover growth, switching to greener suppliers shows a marginally positive relationship. This finding aligns with research suggesting that sustainable supply chain choices can enhance brand value, consumer loyalty, and access to environmentally conscious markets, potentially supporting turnover growth. Conversely, minimizing waste and internal recycling are negatively associated with turnover growth. One plausible interpretation is that these practices require significant upfront investments and entail short-term operational disruptions that temporarily constrain financial returns. Additionally, the lack of immediate monetizable outputs from internal recycling—unlike external waste sales—may limit its contribution to revenue in the short term. These mixed outcomes reflect the complex interplay between environmental strategy and firm performance and support the notion that environmental and economic goals may sometimes be in tension, particularly in the short-to-medium term.

At the theoretical level, our results suggest that firm growth is not inherently linked to the quantitative accumulation of sustainable actions, which challenges the widespread assumption in sustainability management that broader adoption necessarily leads to superior performance (e.g., Porter, 1995; Ambec & Lanoie, 2008; Chistov et al., 2023). Rather, the results may indicate that the quality, strategic fit, and contextual relevance of individual practices may be more critical drivers of assessment for firm growth than the number of actions taken. These results also speak to the tension between the resource-based view of the firm and institutional theories of corporate sustainability. According to RBV (Barney, 1991), firm growth stems from the development of rare, valuable, and inimitable resources—sustainable practices may provide competitive advantage only when integrated deeply into a firm's operational core. The lack of significant effects from *ResEfficiencyBreadth* supports this view, suggesting that superficial or unfocused adoption may not translate into performance gains. At the same time, the findings also reflect on institutional theory (DiMaggio & Powell, 1983), which posits that firms adopt sustainability practices in response to normative or regulatory pressures, often resulting in isomorphic behaviors. If practices are adopted for legitimacy rather than strategic advantage, their effect on growth may be minimal or even negative, especially when implementation is reactive rather than proactive.

Our disaggregated analysis adds further theoretical nuance. The positive relationship between internal recycling and employee growth aligns with the concept of eco-efficiency driving employment through increased internal complexity and process redesign, as suggested by studies emphasizing the role of green innovation in job creation (Rennings, 2000). In contrast, the negative association between selling waste and employment may imply a form of leaner operations or outsourcing of resource loops, reflecting findings by De Marchi and Grandinetti (2013), who showed that not all green practices equally support internal capability development. Similarly, the positive impact of switching to greener suppliers on turnover growth mirrors studies indicating that sustainability along the value chain enhances customer loyalty and market access (Dangelico & Vocalelli, 2017). This lends support to the stakeholder theory view that strategic sustainability practices can create shared value for firms and stakeholders when aligned with market expectations (Hörisch et al., 2014).

We acknowledge that our results may reflect a temporal mismatch between environmental investments and revenue realization or the cost-intensive nature of these practices, particularly in SMEs or early-stage adopters. It is also possible that firms in resource-constrained environments adopt these practices for compliance or ethical reasons, rather than economic ones, echoing Bansal and Roth's (2000) typology of ecological responsiveness.

In terms of corporate growth theory, our findings support a contingency-based perspective, wherein growth outcomes depend not only on environmental orientation but also on the strategic integration of such practices. This aligns with Penrose's (2009) theory that growth is path-dependent and mediated by the firm's internal resources and managerial capabilities. Firms with the same environmental intentions may experience

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different growth trajectories depending on how well these practices are adapted to their business model, industry dynamics, and organizational maturity.

From a managerial perspective, these findings highlight the necessity of a strategic rather than checklist-based approach to sustainability. Firms should not merely aim to maximize the number of practices adopted but should instead assess the relevance and expected return of each practice within their operational and market contexts. The heterogeneity in practice outcomes calls for a more granular understanding of how sustainability initiatives influence internal operations, cost structures, and market positioning. Moreover, firms may need to develop complementary capabilities—such as technical expertise or supply chain partnerships—to fully leverage the benefits of certain environmental practices. Policy implications are equally noteworthy. Public programs that promote environmental performance should account for the differential impact of various resource efficiency measures on economic outcomes. Support mechanisms could be better tailored to encourage practices with dual benefits (economic and environmental), or to help firms transition through the cost-intensive early stages of implementation where economic returns may be delayed. Additionally, labor market policies could be aligned to ensure that skill development and vocational training support employment growth in sectors where green practices are labor-intensive.

In conclusion, while the overall adoption of resource efficiency practices may not guarantee firm growth, certain targeted strategies can influence specific dimensions of performance. Future research should explore the longitudinal effects of these practices, the mediating role of implementation depth and technological intensity, and sectoral variations in the growth–sustainability nexus. Such studies would contribute to a more precise understanding of when, how, and for whom resource efficiency delivers strategic value.

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