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RESEARCH ARTICLE

Linking Extended Business Responsibility to Sustainable Environmental Awareness: Evidence on the Mediating Role of Environmental Values

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ABSTRACT

Eco-conscious businesses are increasingly adopting sustainable materials and improving production efficiency to reduce carbon emissions. These efforts not only minimize waste but also help conserve natural resources. Through extended business responsibility (EBR), firms actively promote sustainable consumption by raising consumer awareness. As awareness grows, purchasing behavior shifts toward environmentally responsible choices, ultimately reducing ecological harm. In contexts where environmental values (EVs) are prominent, social pressure often drives firms toward more sustainable practices. This study addresses a gap in the literature by examining the mediating role of EVs in the relationship between EBR and sustainable environmental awareness (SEA). Based on survey data from 396 participants in Türkiye, partial least squares structural equation modeling (PLS-SEM) was employed for analysis. The findings reveal that EVs partially mediate the relationship between EBR and SEA, serving as a catalyst that enhances the effect of EBR on sustainability awareness. The results provide valuable insights for a wide range of businesses, including manufacturers and e-commerce firms. By aligning with the expectations of environmentally conscious consumers, companies can not only strengthen their sustainability agendas but also gain a sustainable competitive advantage. This study contributes to the literature on sustainable business practices by applying PLS-SEM in the context of an emerging economy and highlighting the critical role of EVs in fostering sustainability awareness.

1 | Introduction

Scholars and policymakers increasingly acknowledge that traditional environmental regulations—focused largely on production processes—are insufficient to drive the systemic changes needed to safeguard environmental and public health. While industrial and energy sectors remain major contributors to pollution, post-consumer waste has gained increasing attention over the past two decades. Despite various policy interventions, current waste management efforts remain inadequate in addressing challenges such as landfill overuse and the need for incineration capacity.

As global consumption rises alongside living standards, complex and durable goods contribute significantly to environmental degradation. In response, environmental values (EVs) have emerged as a core element of firms' strategic and ethical orientation. EVs have impact on long-term sustainability goals, influence corporate social responsibility (CSR) initiatives, and shape brand identity. Integrating such values into business strategy will enable companies to increase competitive advantage—especially as firms navigate evolving regulations and shifting consumer expectations.

Environmentally responsible behavior is guided by knowledge of environmental issues and practical solutions to those

problems, perceived self-efficacy, pro-environmental attitudes, commitment to action, and personal responsibility (Everard et al. 2016; Hines et al. 1987; Hungerford and Volk 1990; Sia et al. 1986). Increasingly, organizations are integrating sustainability into their governance structures, with executives and board members incorporating environmental priorities into strategic decision-making (Ziolo et al. 2019). When firms blend EVs into their culture, they are more likely to invest in sustainability initiatives, even though immediate financial returns are not available. These may include transitioning to renewable energy, adopting circular economy (CE) practices, or implementing waste reduction strategies (Olubusola Odeyemi et al. 2023; Ziolo et al. 2019).

The European Union's circular economy model demonstrates this policy transformation, moving from linear "take-make-dispose" patterns toward resource efficiency and waste minimization. This evolution prioritizes eco-design, recycling, and resource efficiency, aiming to decouple economic growth from environmental degradation (Marín-Beltrán et al. 2022). Moreover, this initiative intends to establish a structured framework fostering research and development, innovation, new employment opportunities, and investment by extending product longevity and preserving value within the economic system. The CE policy adopts a holistic approach by addressing the interrelationship among resources, materials, products, and waste, emphasizing that waste should be viewed as a potential recycled raw material for manufacturing processes.

The CE has emphasized the life-cycle perspective and reinforced the linkages among product standards, resource and waste policies, and chemical regulations. Remarkably, the decisions the firms make during a product's design phase significantly influence all stages of its lifecycle. The fact that a substantial portion of consumed products cannot be recycled, coupled with insufficient awareness on this issue, poses a major threat to natural resources and the economy.

In this context, extended producer responsibility (EPR) has become a key policy instrument (Compagnoni 2022). EPR shifts the burden of post-consumer waste from municipalities to producers, encouraging sustainable product design and reducing environmental externalities (Compagnoni 2022; Park et al. 2024). As such, EPR is directly aligned with CE objectives and plays a central role in fostering environmentally conscious production and consumption. While EPR (Lindhqvist 2000; Tojo 2004) has traditionally been applied to manufacturing firms, it tends to focus narrowly on the responsibilities of producers within physical supply chains. However, in today's increasingly digital and service-oriented economy, environmental impacts are not confined to manufacturing alone. Businesses across various sectors, including e-commerce, digital platforms, logistics, and services, contribute significantly to consumption patterns and environmental outcomes. To address this broader scope, this study introduces the concept of extended business responsibility (EBR) as a generalized framework that builds on the core principles of EPR but applies them to all business types.

However, the relationship between EBR policies and environmental awareness remains underexplored, particularly regarding the mediating role of EVs. While prior research has predominantly examined EBR from regulatory, operational, or strategic perspectives, limited attention has been given to the value-oriented pathways that may shape its effectiveness. This research gap is particularly pronounced in emerging economy contexts, where environmental policies often face implementation challenges due to institutional, economic, and cultural factors. Emerging economies like Turkey present unique contexts for examining EBR-value-awareness relationships. These countries typically experience rapid economic growth alongside increasing environmental pressures, creating tensions between development priorities and sustainability goals. Understanding how EBR policies influence environmental awareness through value mechanisms in such contexts can inform both policy design and implementation strategies.

This study addresses these gaps by investigating the mediating role of EVs in the relationship between EBR and sustainable environmental awareness (SEA) in Turkey. Specifically, we examine whether EVs serve as psychological mechanisms that enhance EBR effectiveness in promoting environmental consciousness. Using data from 396 participants and employing Partial Least Squares Structural Equation Modeling (PLS-SEM), we test a conceptual framework that positions EVs as key mediators linking institutional policies to individual awareness outcomes.

This research contributes to the sustainability literature in three ways. First, it empirically validates the mediating role of EVs in policy-behavior relationships, advancing theoretical understanding of how institutional mechanisms influence individual environmental consciousness. Second, it provides evidence from an emerging economy context, where environmental policy effectiveness may differ from developed country patterns. Third, it offers practical insights for policymakers and managers seeking to enhance EBR program effectiveness through value-based approaches.

The study proceeds as follows: Section 2 reviews relevant literature; Section 3 develops the research model and the hypotheses; Section 4 presents the research methodology; Section 5 reports analytical results; Section 6 discusses findings and presents conclusions; and finally, Section 7 concludes with implications and limitations.

2 | Literature Review

2.1 | Extended Business Responsibility

The notion of business responsibility has evolved significantly over time, expanding from compliance-oriented corporate behavior toward broader accountability for social and environmental outcomes. Macdonald (2011) discusses business responsibility within the context of human rights, emphasizing that business actors and individual decision-makers are accountable for the consequences of their operations. He defines business responsibility as a process through which companies not only comply with national laws but also actively manage potential harm, particularly in relation to human rights. Similarly, Hickle (2017) interprets producer responsibility as an

environmental policy approach closely aligned with CSR, while Riaño and Yakovleva (2019) conceptualize business responsibility as an integral component of broader corporate responsibility frameworks. In contrast, classical economists such as Friedman (1970) and Levitt (1958) contended that a firm's sole responsibility lies in profit maximization, rejecting the extension of responsibility beyond economic objectives.

Following the expansion of CSR debates after the 1970s, the notion of extended responsibility gained traction—initially in the form of EPR for manufacturing firms, and more recently as the broader framework of EBR, applicable to all firms, including those in the service and digital sectors.

While EPR has been a cornerstone of environmental governance, it remains largely confined to the manufacturing sector, emphasizing producer accountability for post-consumption waste and product life-cycle management (Lindhqvist 2000; OECD 2001). However, in today's increasingly digital and service-oriented economy, environmental impacts are not limited to production alone. Businesses across diverse sectors—including e-commerce, digital platforms, logistics, and services—significantly influence consumption patterns and environmental outcomes. Within this context, EBR offers a broader and more integrative conceptual framework. It transcends the traditional producer–consumer relationship by encompassing the environmental obligations of all business actors, including those that may not produce tangible goods yet shape consumption and ecological outcomes (UNEP 2017).

This reconceptualization is not intended as a theoretical departure from EPR but rather as an evolution and broadening of its scope. EBR builds upon the foundational principles of EPR—accountability, life-cycle thinking, and sustainability—but extends them beyond the manufacturing sector to all business contexts. Whereas EPR has traditionally been anchored in product stewardship and waste management (OECD 2001, 2016). EBR situates responsibility within a more comprehensive sustainability framework that includes service-oriented and digital activities. By incorporating non-manufacturing firms, EBR addresses an important gap in the literature—the underrepresentation of service-sector and digital businesses in discussions of environmental accountability (Mont and Tukker 2006).

Moreover, while EPR typically adopts a reactive stance focused on post-consumption waste management, EBR promotes a broader, and more proactive approach, emphasizing green innovation, preventive environmental strategies, and the cultivation of sustainability awareness among consumers and stakeholders. Conceptually, EBR remains consistent with the theoretical foundations of EPR but broadens its application to reflect the realities of modern, service-dominated economies. In doing so, it provides a more inclusive and practical understanding of business responsibility in achieving sustainability across diverse industries.

The concept of EBR has also begun to attract scholarly and practical attention. For example, Engler (2024) applied EBR to assess climate change adaptation laws and policies for marine aquaculture in Chile, while Eberhardt and Majkovic (2016) integrated CSR, corporate citizenship, and sustainable development within the EBR framework, arguing that firms can fulfill societal responsibilities while generating organizational benefits. These contributions suggest that EBR extends the principles of CSR and EPR by embedding environmental and social responsibility across all business activities rather than restricting them to manufacturing contexts.

Conceptually, EBR aligns with contemporary organizational theories that emphasize systemic and strategic responsibility. From a stakeholder theory perspective (Freeman 2010; Freeman and Reed 1983), firms are accountable to a broad range of stakeholders for their environmental performance. Institutional theory (DiMaggio and Powell 1983) explains how societal norms and pressures shape such responsibilities, while the resource-based view (Barney 1991) highlights how environmental stewardship can become a source of competitive advantage. Consequently, EBR should be understood as an integrative and evolutionary framework that reflects the changing realities of modern economies, where service sectors dominate GDP and exert significant environmental influence (El Khoury et al. 2025). By expanding the conceptual boundaries of EPR, EBR provides a more inclusive and forward-looking understanding of business responsibility in achieving sustainability across all industries.

2.2 | Environmental Values

Rising consumer awareness and stricter environmental regulations, global challenges caused by unsustainable consumption patterns (Awan and Abbasi 2025) have pressured businesses to reduce waste and adopt more sustainable practices (Aydinliyim and Pangburn 2012). As a response, many firms have embraced reverse logistics and closed-loop supply chain models, demonstrating that environmental sustainability and profitability are not mutually exclusive (Clottey et al. 2012; Ferguson et al. 2011; Wu and Zhou 2016).

In contexts where EVs are embraced by societal or organizational culture, firms often face greater external pressure to align with sustainable practices. This push can lead to tangible operational changes—such as adopting cleaner technologies, lowering emissions, and building environmentally conscious supply chains. Moreover, EVs influence broader dimensions of CSR by extending environmental concern into areas like employee engagement, community collaboration, and stakeholder transparency (Watson et al. 2018).

Firms with strong EVs often go beyond compliance to actively engage in sustainability initiatives by collaborating with NGOs on environmental programs, participating in local green initiatives, contributing to global sustainability efforts such as biodiversity protection and climate action.

Transparency is a defining trait of such firms, which regularly communicate their environmental efforts through sustainability reporting, stakeholder consultations, and environmental impact assessments (Kang and Hustvedt 2014). Internally, these organizations foster a culture of environmental responsibility by encouraging sustainable behavior among employees, offering green incentives, and integrating sustainability metrics into performance evaluations. In doing so, they foster

a culture where sustainability is not just a strategic objective but also a shared commitment across all levels of the organization.

Firms that embed EVs into their business models often prioritize minimizing waste and reducing resource consumption (Whalen 2019). Rather than treating waste as an afterthought, these firms take a proactive approach by incorporating strategies such as reusing materials, recycling, and implementing eco-design principles from the outset. One of the most effective ways to align with EVs is to address waste across every stage of the production cycle, from raw material sourcing to manufacturing and distribution (Braungart et al. 2007). This may involve adopting waste-to-energy technologies, streamlining manufacturing processes to reduce material inputs, or moving toward zero-waste production models. By rethinking how materials are used and recovered, these companies not only improve environmental outcomes but also enhance operational efficiency and resilience within their supply chains. Recycling and reuse require businesses that embrace EVs to establish robust systems for recycling materials, reusing packaging, and encouraging end-of-life product recycling (e.g., take-back schemes for electronics or furniture) (Muranko et al. 2021). Eco-product design increasingly incorporates environmental considerations, such as modularity, ease of disassembly for recycling, and the use of sustainable materials. These efforts align with the principles of the CE, aiming to reduce environmental impact throughout a product's lifecycle.

One of the most remarkable ways EVs are reflected in business operations is through green innovation. In this regard, firms increasingly use environmental sustainability not just as a compliance goal, but as a competitive advantage. This can take shape in the development of sustainable technologies, environmentally conscious product design, and partnerships with stakeholders who share ecological priorities. For instance, companies may invest in technologies that reduce environmental harm, such as renewable energy solutions (e.g., solar, wind, or hydrogen), carbon capture systems, or water conservation innovations (Dincer and Acar 2015). Beyond technology, firms that prioritize EVs often adjust their product offerings to meet the rising consumer demand for sustainability. These products tend to be energy efficient, produced from recycled or responsibly sourced materials, and designed for longevity, reusability, or repairability—thus extending their useful life and reducing overall waste. Collaboration with eco-conscious suppliers, governments, and NGOs further increase these efforts, allowing firms to co-create products and services that align with broader environmental objectives. Such strategic alliances not only reinforce a company's commitment to sustainability but also help strengthen its position in the marketplace by integrating it within an environmentally responsible value network.

At the individual level, EVs play a critical role in shaping pro-environmental attitudes and behaviors. People who prioritize environmental well-being are often essentially motivated to make lifestyle choices that reflect ecological responsibility (Qazi et al. 2021). These values form a moral foundation that influences decisions—encouraging actions that are perceived as environmentally beneficial and discouraging those that carry ecological harm (Steg and Nordlund 2018). Empirical research supports this link between EVs and behavior. Studies have consistently shown that individuals with strong EVs are more likely to engage in sustainable practices such as recycling (Khalil et al. 2022; Sorkun 2018; Zuo et al. 2017), reducing reliance on private vehicles (Nordlund and Garvill 2003), using public transportation (Bamberg et al. 2007), choosing organic food options (Cheung and To 2019), and properly disposing of electronic waste (Sorkun 2018; Zuo et al. 2017). These behaviors are often driven by a sense of moral responsibility, which serves as a powerful predictor of environmentally friendly action. Therefore, EVs help explain why individuals differ in their environmental choices, from avoiding littering to adopting the "3R" principles: reuse, reduce, and recycle. In this broader context, EBR also emerges as a fundamental tool in aligning industry practices with EVs. As a sustainability-driven policy model, EBR encourages businesses to absorb environmental costs and improve resource efficiency across the product life cycle (Cai and Choi 2021; Rubio et al. 2019). For example, sustainable logistics practices, including waste management under EPR frameworks, have been shown to enhance a company's environmental image (Baah et al. 2021). Responsible producers often respond by adopting environmentally friendly materials and optimizing production efficiency, resulting in waste minimization and natural resource conservation. At the consumer level, EPR initiatives also play an educational role. They inform the public about sustainable consumption and help raise environmental awareness. As people become more informed, their consumption habits often shift toward more ecologically responsible patterns. In this way, EPR not only supports sustainable production but also reinforces EVs and contributes to the development of widespread SEA.

2.3 | Sustainable Environmental Awareness

In this study, SEA is defined as the integrated cognitive, affective, and behavioral understanding of environmental issues through the lens of sustainability, reflecting not only knowledge of ecological challenges but also a commitment to long-term, responsible practices. This definition highlights that awareness is not simply informational but also involves values, attitudes, and intentional behaviors directed at fostering sustainable outcomes. Although the concept of SEA has not been explicitly standardized in the existing literature, it can be positioned at the intersection of research on environmental awareness, sustainability consciousness, and ecological responsibility. Traditional notions of environmental awareness have largely focused on individuals' knowledge and concern regarding environmental problems (Wesley Schultz 2001), while sustainability awareness emphasizes the long-term integration of ecological, social, and economic considerations into decision-making processes (Lozano 2006). SEA extends these perspectives by conceptualizing awareness as both immediate and future-oriented, where individuals and organizations recognize the environmental consequences of their actions within a sustainability framework that transcends short-term ecological concerns.

Theoretically, SEA can be linked to the dynamic interaction between EBR and EVs. EBR represents firms' institutionalized commitment to sustainability, extending responsibility beyond producers to include all types of businesses that shape environmental outcomes. By embedding ecological accountability into organizational strategies and practices, EBR creates structural conditions that foster awareness at both organizational and societal levels. EVs, in turn, function as the mediating mechanism that translates institutional commitments into individual or collective awareness. As Schwartz (1992) suggests, values serve as guiding principles that shape perceptions and behaviors; thus, EV channels the influence of EBR into heightened recognition of sustainable practices. Ultimately, SEA emerges as the dependent outcome of this interaction: a heightened state of awareness that reflects the combined effect of institutional responsibility and value-driven orientations.

In line with this framework, previous research has demonstrated that personal EVs positively influence individuals' engagement in pro-environmental behaviors (Qazi et al. 2021). Individuals with strong EVs show greater commitment to ecological preservation by actively participating in sustainable practices, whereas those with weaker values tend to exhibit lower levels of engagement (Bhuian and Sharma 2017). This engagement can manifest by proactively engaging voluntary sustainability actions such as participating in environmental initiatives, recycling, and supporting sustainable innovation—and by using resources efficiently, minimizing waste, and adopting responsible consumption habits.

Both dimensions have significant implications for sustainability-aware consumer behavior, which contributes to positive environmental outcomes such reduced reliance on private vehicles (Tanner 1999), lower energy usage in green manufacturing processes (Jansson et al. 2010), and preference for resource-efficient products (Guagnano et al. 1995). Moreover, engaging environmentally conscious consumers and stakeholders in early innovation processes enhances the quality of green product design, strengthens corporate environmental responsibility, and builds trust through transparent collaboration. Early-stage participation helps firms uncover tacit sustainability-related knowledge and latent consumer needs (Chaithanapat and Rakthin 2021), while integrating external expertise with internal capabilities creates a more resilient and adaptive sustainability strategy (Caloghirou et al. 2004).

Such participatory innovation not only signals transparency and corporate accountability (Hadj 2020) but also deepens trust and loyalty among sustainability-conscious consumers (Papadas et al. 2019; Parris et al. 2016). When effectively managed, this collaborative approach reduces long-term environmental impacts and strengthens both brand equity and environmental performance (Bigliardi and Filippelli 2022; Yi et al. 2024).

Within this context, the operationalization of SEA in this study—through indicators such as recycling intentions, resource efficiency, repair and reuse behaviors, and sustainable consumption choices—captures both the proactive and efficiency-oriented dimensions of sustainability awareness. This dual conceptualization reflects the integrative and behavioral nature of SEA as both an attitudinal and action-oriented construct.

3 | Research Model and Hypotheses

Based on the preceding literature review, this section outlines the conceptual framework and the hypotheses developed to guide the empirical analysis. The model aims to investigate the mediating role of EVs in the relationship between EBR and SEA.

As illustrated in Figure 1, the conceptual model positions:

- **EBR** as the independent variable,
- **EVs** as the mediating variable, and
- **SEA** as the dependent variable

To empirically examine the relationships among these constructs, the study proposes the following hypotheses:

- H1: EBR has a positive effect on EVs.
- H2: EVs have a positive effect on SEA.
- H3: EBR has a positive effect on SEA.
- H4: EVs mediate the relationship between EBR and SEA.

This framework offers a pathway to better understand how regulatory instruments like EBR can indirectly enhance environmental awareness by reinforcing EVs.

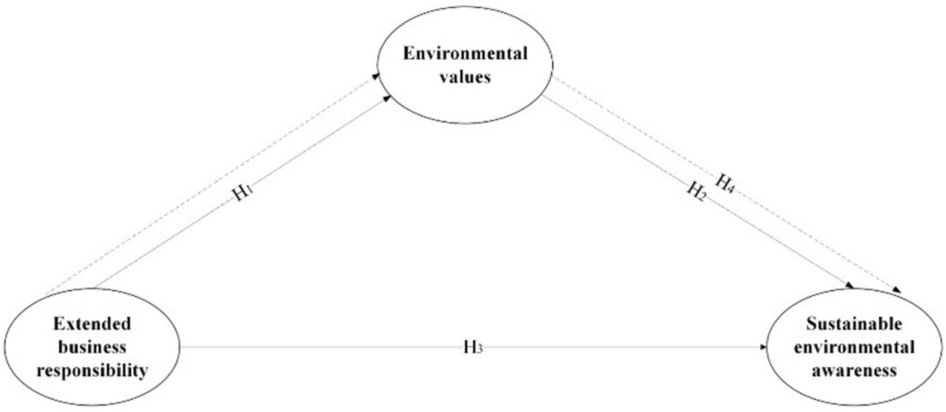

FIGURE 1 | Research model.

4 | Methodology

This study employed a quantitative survey design to assess participants' perceptions and test the proposed hypotheses. A quantitative approach was deemed appropriate for hypothesis testing and empirical validation, aligning with established research guidelines (Creswell and Creswell 2023).

The EBR and EVs scales were adapted from Ofori and Opoku Mensah (2022), whose instrument was developed based on the conceptual foundations established by Lindhqvist (2000) and Tojo (2004). Although these earlier works do not provide quantitative measurement items, they offer essential theoretical grounding for understanding producer and business responsibility within the sustainability context. To ensure applicability in the Turkish context, a rigorous translation and cultural adaptation process was conducted, involving multiple iterations to achieve both linguistic accuracy and conceptual equivalence.

However, no existing instrument in the literature adequately captured the specific dimensions of SEA targeted in this study. Therefore, a new SEA scale was developed by the authors. The process began with qualitative focus group studies involving industry managers who provided valuable insights into environmental awareness practices. Drawing on these findings, a preliminary item pool was created and refined through multiple stages of expert validation to ensure clarity, fluency, and relevance.

The scale development followed a structured, multi-stage process. Initially, an item pool was generated based on an extensive literature review and expert input from both academia and industry. The items were reviewed by four academic experts to assess content validity, focusing on representativeness, clarity, and conceptual alignment. Items deemed ambiguous or redundant were revised or removed accordingly. Subsequently, face validity was examined through a focus group involving senior managers with sustainability experience and academic participants. Feedback was obtained regarding item comprehensibility and practical relevance, leading to further refinements. A preliminary version of the questionnaire was then pilot tested to identify any residual linguistic or conceptual inconsistencies. Minor revisions were made based on their feedback, resulting in the final version of the SEA scale. At the conclusion of this process, 10 items were retained to represent the SEA construct. Responses were measured on a 5-point Likert scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (5). These items are presented in Table 5. Participants were instructed to evaluate the items with respect to their SEA practices. Finally, construct validity was verified during the pilot testing phase using exploratory factor analysis (EFA), confirming that the retained items coherently reflected the underlying SEA dimension.

The newly developed SEA items were evaluated during the pilot testing phase, where content validity was ensured through expert feedback and construct validity was assessed using EFA. The pilot results confirmed that all factor loadings exceeded the recommended threshold of 0.50 (Hair et al. 2019), and the KMO value (0.86) indicated sampling adequacy (Kaiser 1974). Bartlett's Test of Sphericity was also significant ($p < 0.001$), supporting the suitability of the data for factor analysis. The reliability of the SEA scale was further confirmed with Cronbach's alpha values above 0.80, exceeding the generally accepted minimum of 0.70 (Nunnally 1978). Additionally, composite reliability (CR) values were above 0.80, and average variance extracted (AVE) values were above 0.50, demonstrating strong internal consistency and convergent validity (Fornell and Larcker 1981). During the pilot phase, respondents also provided feedback on item clarity and interpretation, and the results showed that all items were clearly understood and semantically consistent. Following these validations, we proceeded with data collection for the main study. The analysis conducted on the full sample confirmed that the SEA scale maintained its validity and reliability at a statistically robust level.

The final instrument included demographic questions and structured items rated on a 5-point Likert scale. A convenience sampling method was used due to practical constraints. The study targeted individuals aged 18 and above, selected based on their autonomy in purchasing decisions, product use, and potential for sustainability-related decision-making. The cross-sectional design enabled the examination of participant responses at a single point in time, providing a snapshot suitable for generalization within the study's scope (Fowler 2014).

Data were collected via an online survey distributed through various social media platforms using snowball sampling. Researchers used snowball nonprobability convenience sampling by initially connecting with professionals or groups on social media platforms (e.g., LinkedIn and Facebook student nurse groups) that most closely aligned with the target population (Leighton et al. 2021). Participation was voluntary, and informed consent was obtained.

Following guidelines by Hatcher (2014), Streiner (1994), and Hair et al. (2014), a sample size exceeding 100 and a minimum ratio of 5 to 10 observations per variable were required to ensure statistical reliability. This study collected cross-sectional data from 396 participants in Türkiye—surpassing these thresholds. Table 1 presents the demographic profile of respondents. The majority of participants were Generation Z, single, held a bachelor's degree, and were non-managerial employees.

5 | Data Analysis

The hypothesized structural model was tested using PLS-SEM via SmartPLS 4.0, with data preparation and descriptive statistics performed in SPSS 24.0.

5.1 | Exploratory and Confirmatory Factor Analysis

EFA employing varimax rotation was conducted separately on the items for the EBR, EVs, and SEA constructs to identify their underlying dimensional structures. The objective was to derive a parsimonious set of distinct, non-overlapping variables. A Confirmatory Factor Analysis (CFA) was conducted to

TABLE 1 | Demographic profile of respondents.

Characteristics	*n*	%
Age		
18–25	258	65.1
26–33	32	8.1
34–41	47	11.9
42–49	31	7.8
50+	28	7.1
Gender		
Female	192	48
Male	204	52
Marital status		
Single	304	76.8
Married	92	23.2
Management level		
Senior manager	42	10.6
Middle-level manager	46	11.6
Lower-level manager	54	13.7
Employee	254	64.1
Education level		
Post-graduate degree	41	10.4
Bachelor's degree	244	61.6
High school	78	19.7
Middle school	33	8.3
Total	396	100.0

assess internal consistency, convergent validity, and discriminant validity of the reflective constructs (Hair et al. 2014). Internal consistency reliability was evaluated using composite reliability (CR), and Cronbach's alpha (α). Convergent validity was assessed by calculating the AVE based on the items' factor loadings. The results of these analyses are presented in Table 2.

Although conventional psychometric guidelines recommend removing items with factor loadings below 0.50 (Afthanorhan 2014), such decisions should be supported by methodological justification. Therefore, this study retained items with loadings of 0.50 or higher, in line with established criteria (Afthanorhan 2014; Hair et al. 2014). Reliability and validity were evaluated using widely accepted benchmarks: Cronbach's alpha and CR values above 0.70 were considered satisfactory (Hair et al. 2014). and AVE values above 0.50 indicated acceptable convergent validity (Fornell and Larcker 1981).

The three scales used in the study were subjected to EFA. Since the EBR and EVs scales were adopted from a previous study, they were confirmed to be unidimensional in this study as well, based on the EFA results. However, the SEA scale, developed within the scope of this research, was found to split into two sub-dimensions as a result of the EFA. These two dimensions were named according to the statements they encompass. The first dimension comprises items SEA1, SEA2, SEA3, SEA5, and SEA6. The items in this group appear to emphasize the individual's active participation in sustainability efforts, voluntary actions, and personal initiatives. The second dimension comprises items SEA4, SEA7, SEA8, SEA9, and SEA10. The items in this group are notably focused on the efficient use of resources, waste reduction, and the minimization of consumption. Accordingly, the first dimension is named "Proactive Engagement in Sustainability," and the second dimension is named "Resource Efficiency and Waste Minimization." However, since the other variables in the research model were unidimensional, it was deemed methodologically consistent to also treat the SEA variable as a single, unidimensional construct in the subsequent analysis.

As summarized in Table 2, the results indicate strong psychometric properties. Cronbach's alpha coefficients ranged between 0.848 and 0.905, and CR values varied from 0.883 to 0.946, both exceeding the recommended levels. AVE values fell between 0.518 and 0.661, also surpassing the minimum criterion. Collectively, these results confirm the internal consistency and convergent validity of the constructs and support the robustness of the measurement model for hypothesis testing within the proposed framework.

Discriminant validity was assessed using two complementary methods: the Fornell–Larcker criterion (Fornell and Larcker 1981) and the heterotrait–monotrait ratio (HTMT) of correlations (Henseler et al. 2015). According to Fornell and Larcker's approach, discriminant validity is established when the square root of each construct's AVE is greater than its correlations with other constructs. This indicates that the construct shares more variance with its own indicators than with those of other variables in the model.

As shown in Table 3, the results meet the Fornell–Larcker criterion and provide evidence that the constructs are empirically distinct from one another.

As outlined by Henseler et al. (2015), the HTMT is calculated as the ratio between: (1) the average of heterotrait-heteromethod correlations (which are correlations between items from different constructs), and (2) the geometric mean of monotrait-heteromethod correlations (which are within-item correlations of the same construct). Henseler et al. (2015) suggest a conservative threshold of HTMT < 0.90, with a more stringent cutoff of HTMT < 0.85 for conceptually distinct constructs, to ensure the rigor of discriminant validity (Ülker-Demirel and Yıldız 2021). As presented in Table 4, the HTMT values obtained in this study adhere to these established benchmarks, thereby empirically confirming the discriminant validity of the measurement model.

An examination of Table 4 reveals that all HTMT values fall below the recommended threshold. As evidenced by the data presented in Tables 3 and 4, the measurement model meets all

TABLE 2 | Factor analysis and reliability values of the construct.

Constructs/items		Factor loadings (EFA)	Factor loadings (CFA)	Eigen-value	Variance explained (%)	Cronbach's alpha (α)	CR	AVE
Extended business responsibility				6.572	24.342	0.858	0.883	0.518
	EBR1	0.640	0.666					
	EBR2	0.670	0.708					
	EBR3	0.728	0.691					
	EBR4	0.722	0.692					
	EBR5	0.763	0.695					
	EBR6	0.685	0.721					
	EBR7	0.615	0.749					
	EBR8	0.694	0.781					
Environmental values				4.140	15.332	0.936	0.946	0.661
	EVs1	0.728	0.776					
	EVs2	0.725	0.785					
	EVs3	0.819	0.826					
	EVs4	0.779	0.839					
	EVs5	0.756	0.809					
	EVs6	0.789	0.841					
	EVs7	0.772	0.823					
	EVs8	0.811	0.859					
	EVs9	0.672	0.754					
Sustainable environmental awareness						0.905	0.922	0.545
Proactive engagement in sustainability	SEA1	0.628	0.618	2.571	9.522			
	SEA2	0.520	0.757					
	SEA3	0.777	0.546					
	SEA5	0.552	0.750					
	SEA6	0.518	0.675					
Resource efficiency and waste minimization	SEA4	0.510	0.787	3.435	12.723			
	SEA7	0.651	0.810					
	SEA8	0.740	0.808					
	SEA9	0.767	0.814					
	SEA10	0.732	0.766					

Note: KMO measure of sampling adequacy = 0.937. Barlett test of sphericity = 6473.194, $p = 0.000$.

requisite discriminant validity criteria. Both the Fornell-Larcker criterion (Fornell and Larcker 1981), which compares the square root of AVE with inter-construct correlations, and the more contemporary HTMT ratio (Henseler et al. 2015) confirm that the constructs maintain sufficient discriminant validity. These results not only satisfy methodological requirements but also substantiate the theoretical distinctiveness of the constructs within the proposed framework. In addition, correlation coefficients for the constructs are given in the Appendix, showing statistically significant relationships among all variables.

5.2 | Path Analysis

The conceptual framework was tested with PLS-SEM. The path analysis results of the model are given in Table 5.

TABLE 3 | Discriminant validity (Fornell–Larcker criteria).

Variables	Environmental values	Extended business responsibility	Sustainable environmental awareness
Environmental values	0.813		
Extended business responsibility	0.326	0.720	
Sustainable environmental awareness	0.726	0.372	0.738

TABLE 4 | Discriminant validity (HTMT criteria).

Variables	Environmental values	Extended business responsibility	Sustainable environmental awareness
Environmental values			
Extended business responsibility	0.347		
Sustainable environmental awareness	0.774	0.415	

TABLE 5 | Model testing results.

Constructs/items		VIF	R^2
Extended business responsibility	EBR1: "Product labels direct and warns users of the dangers of improper recycling."	1.491	
	EBR2: "Adverts by producers/retailers encourage proper waste disposal."	1.551	
	EBR3: "Product manuals have procedures for recycling an item when it becomes waste."	1.685	
	EBR4: "Product labels contain clear guidelines on how to safely dispose of the waste."	1.779	
	EBR5: "Some retailers make known areas where items can be recycled at the point of purchase."	1.681	
	EBR6: "I am assured of a take-back when I find a challenge with a product."	1.622	
	EBR7: "The content of some promotional messages encourages one to engage in proper waste recycling."	1.816	
Environmental values	EVs1: "Pollution generated from dump sites harm people all over the country."	2.439	0.106
	EVs2: "The effects of pollution on public health is worse than we realize."	2.625	
	EVs3: "Human activities are endangering the environment."	2.763	
	EVs4: "Electronic waste is a serious problem both locally and globally."	2.943	
	EVs5: "Proper waste management reduce the health related risk for everyone."	2.568	
	EVs6: "Practising proper waste management reduce the use of landfills and protect our environment."	2.892	
	EVs7: "Practising proper waste management conserve natural resources".	2.851	
	EVs8: "Practising proper waste management improves the quality of the environment for everyone."	3.149	
	EVs9: "Practising proper waste management improve the economic livelihoods of workers in the electronic waste business."	2.023	

(Continues)

TABLE 5 | (Continued)

Constructs/items		VIF	R^2
Sustainable environment awareness	SEA1: If companies' open innovation processes are accessible, I am considering participating in these activities.	1.593	0.547
	SEA2: I am thinking of separating the materials I use (instead of throwing them away, placing them in appropriate recycling bins).	1.953	
	SEA3: I am considering participating in volunteer work.	1.515	
	SEA4: I intend to use a product for as long as possible.	2.348	
	SEA5: Instead of throwing away a broken product and buying a new one, I intend to repair it or have it repaired.	2.205	
	SEA6: If products I own break down, I intend to disassemble them and repurpose the components for other uses.	2.316	
	SEA7: I intend to avoid waste.	1.863	
	SEA8: I intend to use water efficiently.	2.559	
	SEA9: I intend to use electricity efficiently.	2.768	
	SEA10: I intend to reduce paper usage.	2.348	

Note: The EBR construct initially comprised 8 items. Following PLS-SEM estimation, the original EBR1 ("I see how the used product or its packaging should be recycled on the product labels") was removed due to its lowest factor loading to improve model quality. The remaining items were renumbered accordingly (original EBR2–EBR8 became EBR1–EBR7).

TABLE 6 | Hypotheses results.

Hypotheses	β	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	*p*	Results
Direct effects						
H1	0.326	0.331	0.049	6.664	0.000	Accepted
H2	0.677	0.677	0.030	22.366	0.000	Accepted
H3	0.151	0.153	0.044	3.446	0.001	Accepted
Mediating effect						
H4	0.221	0.224	0.035	6.297	0.000	Accepted

An examination of the variance inflation factor (VIF) values revealed that all constructs remained below the established threshold of 5 (see Table 5), indicating no evidence of multicollinearity (Hair et al. 2014). Additionally, the model's explanatory power, as reflected in the R^2 values, demonstrated that EVs accounted for 10.6% of the variance, while SEA explained 54.7% of the variance. Standardized root mean square residual (SRMR), one of the model fit indices provided by SmartPLS, which quantifies the discrepancies between the sample covariances and the implied ones derived from the parameters (Cho et al. 2020). According to Henseler et al. (2015), and Cho et al. (2020), SRMR values should be lower than 0.08 (for a sample size greater than 100) (Iqbal et al. 2021). The SRMR value obtained in this study is 0.063, which falls below the recommended threshold of 0.08, indicating an acceptable model fit. Additionally, as the model fit indices, the chi-square (χ^2) value of 1050.943 and a normed fit index (NFI) of 0.837 (NFI >0.80 indicates satisfactory fit), both of which are within the acceptable range (Bentler and Bonett 1980).

Table 6 and Figure 2 present the results of path analyses and hypothesized relationships. The results of the hypothesis testing indicate that EVs exert a partial mediating effect on the relationship between EBR and SEA. This finding indicates that EVs not only mediate but also strengthen the relationship between EBR and SEA. As a result, all the proposed hypotheses are empirically supported.

6 | Discussions and Conclusion

6.1 | Discussion

The findings of this study offer robust empirical support for the hypothesized relationships in the research model. Specifically, EBR was found to have a significant positive impact on EVs ($\beta = 0.326$, $p = 0.000$), confirming H_1. This aligns with previous research indicating that EBR policies incentivize firms to adopt sustainable practices, thereby reinforcing pro-EVs among stakeholders (Lindhqvist 2000; Tojo 2004). Additionally, EVs significantly influenced SEA ($\beta = 0.677$, $p = 0.000$), supporting H_2 and consistent with earlier studies that link EVs to pro-environmental behavior (Qazi et al. 2021; Steg and Nordlund 2018).

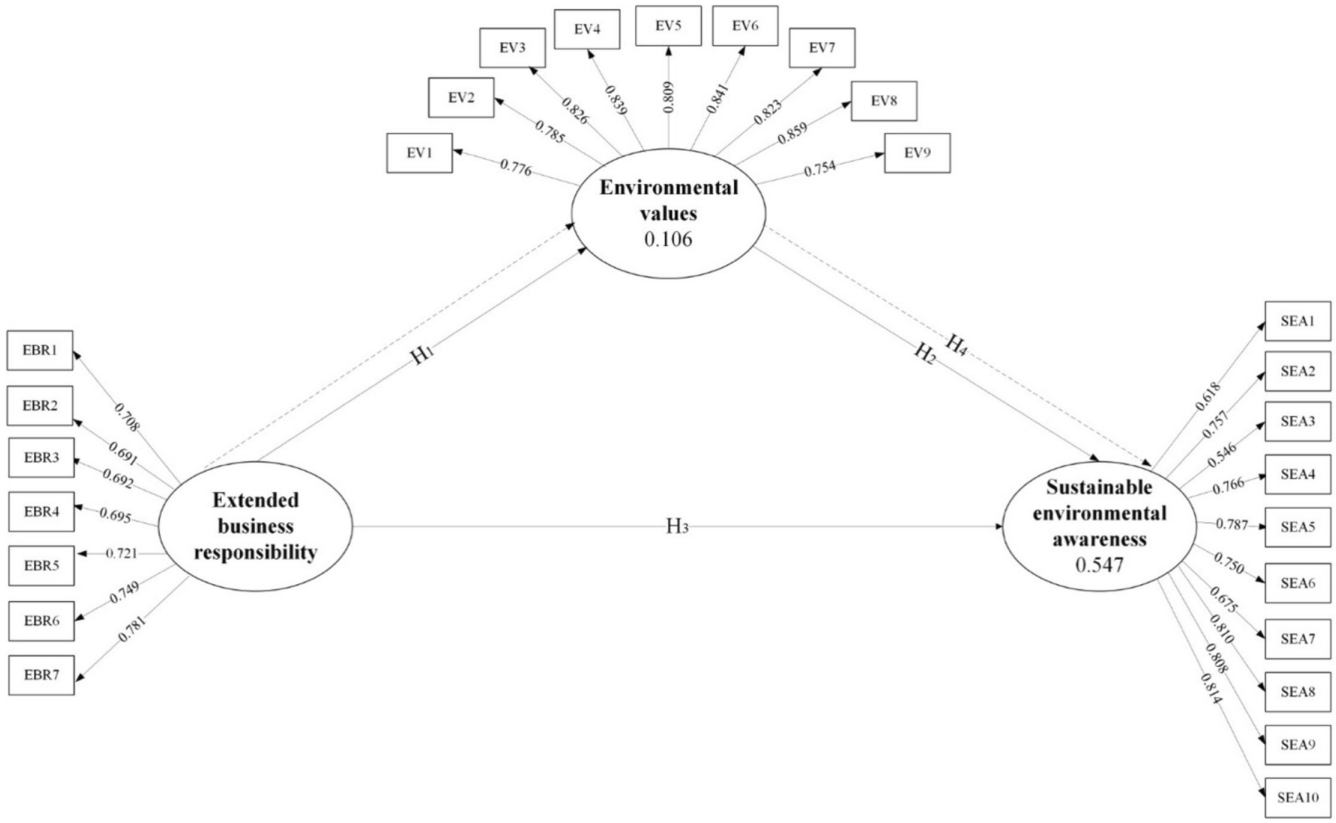

FIGURE 2 | Structural model.

The direct effect of EBR on SEA was also significant ($\beta = 0.151$, $p = 0.001$), confirming H_3. However, the effect size was smaller than the indirect path via EVs, highlighting the amplifying role of values in converting regulatory initiatives into meaningful awareness and behavioral change. The mediation analysis confirmed that EVs partially mediate the EBR–SEA relationship ($\beta = 0.221$, $p < 0.001$), supporting H_4. This suggests that EBR can foster sustainable awareness both directly and indirectly, through the development of EVs. By positioning SEA within this framework, the study contributes theoretically by filling a conceptual gap in the sustainability literature. It not only clarifies the distinctiveness of SEA compared to existing constructs but also explains its role as a theoretically grounded outcome variable that links business responsibility and EVs to sustainable awareness.

These findings highlight the importance of integrating EBR policies with value-based educational campaigns to maximize their effectiveness in promoting sustainable behaviors.

6.2 | Conclusion

This study addresses a gap in the literature by examining the mediating role of EVs in the relationship between EBR and SEA. Based on survey data from 396 participants in Türkiye, PLS-SEM was employed for analysis. The findings reveal that EVs partially mediate the relationship between EBR and SEA, serving as a catalyst that enhances the effect of EBR on sustainability awareness.

These results contribute to the literature by empirically validating EVs as a key psychological mechanism linking institutional frameworks like EBR to individual sustainability outcomes.

While EBR alone can positively influence SEA, its effectiveness is significantly enhanced with stakeholders' EVs. For businesses, embedding sustainability into core strategies and brand identity can foster consumer trust and long-term competitiveness.

Although this study was designed with general business practices in mind, its findings also have implications for e-commerce and digital businesses. In the e-commerce business, consumer values play a pivotal role, especially as environmentally conscious consumers increasingly influence online purchasing trends. Our results indicate that EVs play a catalyst role and contribute to SEA, which e-commerce firms can leverage to align with sustainability goals. By addressing the expectations of environmentally sensitive consumers, e-commerce firms not only advance their sustainability agendas but also differentiate themselves in a competitive landscape—thereby gaining a sustainable competitive advantage.

Previous studies support these findings. For example, Zhang et al. (2023) found that consumers highly engaged with environmental protection exhibit more favorable attitudes toward digital fashion. Similarly, Yao et al. (2024) demonstrated that environmental awareness significantly influences Buy Online, Return In-Store adoption, both directly and indirectly. In line

with this, Türkeş (2024) reported that sustainability orientation has a positive and significant effect on the performance of online SMEs.

In conclusion, this study demonstrates that EVs act as a vital bridge between institutional environmental responsibility and individual environmental awareness. Integrating EBR policies with EVs can accelerate the transition toward a circular economy and reduce ecological degradation, particularly in emerging economies like Türkiye.

7 | Implications and Limitations

7.1 | Managerial Implications

EVs are not simple ethical commitments—they form a core component of long-term competitive strategy. Firms that integrate sustainability into their core values can achieve operational efficiency through waste reduction, energy-saving technologies, and optimized supply chains. While initial investments in renewable energy or sustainable materials may appear costly, they often result in long-term savings and reduced exposure to price volatility. Moreover, sustainability-oriented innovation—such as eco-friendly packaging or energy-efficient products—can unlock new market opportunities and strengthen brand reputation.

Digital transformation plays a critical enabling role in advancing sustainability initiatives particularly for e-commerce businesses. Managers should selectively adopt technologies that align with their business models and directly contribute to environmental performance improvements. Strategic alignment of digital tools—such as sensors for energy tracking or AI for supply chain optimization—can amplify the effectiveness of EBR and sustainability programs.

Adopting internationally recognized standards like ISO 14001 helps firms systematically manage their environmental responsibilities. Certification demonstrates a commitment to sustainable resource use, regulatory compliance, and continuous improvement in environmental performance. For manufacturers, ISO 14001 serves as a credible signal to consumers, investors, and partners, enhancing trust and reliability.

To drive sustainability-oriented innovation, firms should engage in open innovation models involving stakeholders such as universities, NGOs, consumers, and public institutions.

Managers should prioritize education and transparency to strengthen stakeholder engagement:

- Launch social marketing campaigns promoting sustainable behaviors,
- Organize educational programs for environmental literacy,
- Publish comprehensive sustainability reports,
- Advocate for transparency awards recognizing leading firms in disclosure practices.

7.2 | Limitations, and Future Research Directions

While this study provides meaningful insights into the relationship between EBR, EVs, and SEA, several limitations should be acknowledged.

First, the research was conducted in Türkiye, an emerging economy with specific socio-cultural and regulatory characteristics. As such, the generalizability of findings may be limited. Future studies could replicate the model in other emerging and developed markets to facilitate cross-cultural comparisons and validate the robustness of the findings.

Second, the use of a cross-sectional survey restricts the ability to draw causal inferences. Longitudinal research designs would allow for a better understanding of how EVs and sustainability awareness evolve over time, particularly in response to policy or organizational interventions.

Third, the sample predominantly comprised younger, educated individuals (primarily from Generation Z), which may not fully represent the broader population. Future studies should aim for greater demographic diversity, including varied age groups, occupational sectors, and educational backgrounds, to improve external validity.

Fourth, the reliance on self-reported data may introduce social desirability bias. Integrating objective measures—such as actual recycling behaviors, participation in take-back programs, or digital engagement with sustainability platforms—could enhance the reliability of future research.

Future research could explore the moderating effects of demographic factors such as age, education, or environmental literacy on the relationship between EBR and SEA. Additionally, the role of digital tools—including gamification, AI-driven awareness campaigns, mobile apps, and IoT-enabled tracking—merits investigation for their potential to enhance EVs and behavioral change.

Comparative studies could also examine the differential impact of voluntary versus regulatory EBR frameworks, evaluating their effectiveness in promoting sustainability across different policy environments.

This study also contributes methodologically by developing a SEA measurement scale tailored to the study's context. Future research may adopt and validate this scale across diverse settings to establish its reliability and applicability as a robust tool for measuring sustainability awareness. For methodological consistency with the other unidimensional variables in the research model, the SEA variable was also treated as a single construct. This can be considered a limitation of the present study. A fruitful avenue for future research would be to operationalize the developed SEA variable as a two-dimensional construct. This would enable examining the unique effects of the two factors revealed by the EFA—proactive circular engagement and resource conservation and efficiency—thereby enriching the literature with more detailed insights.

Furthermore, qualitative approaches—such as in-depth interviews with corporate leaders—could provide deeper insight into strategic motivations, barriers, and enablers of environmental policy adoption. Extending these perspectives to include employees, suppliers, and community stakeholders would offer a more comprehensive understanding of firm-level environmental engagement.

Finally, case studies of organizations with successful EBR or sustainability integration could serve as best-practice benchmarks, offering actionable insights for firms seeking to align EVs with business strategy.

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During the preparation of this manuscript the authors used Chatgpt 4o in order to edit the manuscript. After using this tool/service, the authors have reviewed and edited the output and take full responsibility for the content of this publication.

Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix

Correlation Matrix

	EBR1	EBR2	EBR3	EBR4	EBR5	EBR6	EBR7	EBR8	EVs1	EVs2	EVs3	EVs4	EVs5	EVs6
EBR1	1													
EBR2	0.437***	1												
EBR3	0.499***	0.443***	1											
EBR4	0.344***	0.426***	0.486***	1										
EBR5	0.407***	0.414***	0.442***	0.539***	1									
EBR6	0.337***	0.387***	0.386***	0.458***	0.537***	1								
EBR7	0.321***	0.41***	0.386***	0.369***	0.383***	0.438***	1							
EBR8	0.395***	0.436***	0.43***	0.409***	0.464***	0.497***	0.567***	1						
EVs1	0.237***	0.152***	0.151***	0.134***	0.105**	0.133***	0.305***	0.204***	1					
EVs2	0.207***	0.242***	0.126**	0.15***	0.112**	0.189***	0.315***	0.233***	0.666***	1				
EVs3	0.218***	0.181***	0.109**	0.131***	0.104**	0.177***	0.212***	0.169***	0.653***	0.684***	1			
EVs4	0.228***	0.241***	0.168***	0.176***	0.07*	0.176***	0.234***	0.201***	0.548***	0.649***	0.695***	1		
EVs5	0.257***	0.255***	0.225***	0.175***	0.132***	0.172***	0.232***	0.194***	0.55***	0.513***	0.585***	0.68***	1	
EVs6	0.135***	0.226***	0.14***	0.169***	0.111**	0.126***	0.234***	0.188***	0.584***	0.571***	0.627***	0.688***	0.703***	1
EVs7	0.209***	0.167***	0.156***	0.128**	0.052*	0.089***	0.189***	0.197***	0.621***	0.507***	0.626***	0.638***	0.644***	0.702***
EVs8	0.205***	0.215***	0.116**	0.149***	0.075*	0.196***	0.265***	0.227***	0.62***	0.599***	0.645***	0.664***	0.664***	0.692***
EVs9	0.248***	0.257***	0.203***	0.227***	0.18***	0.296***	0.272***	0.309***	0.461***	0.556***	0.554***	0.557***	0.574***	0.574***
SEA1	0.215***	0.198***	0.176***	0.182***	0.174***	0.271***	0.282***	0.218***	0.327***	0.278***	0.289***	0.36***	0.335***	0.334***
SEA2	0.18***	0.174***	0.172***	0.189***	0.149***	0.219***	0.286***	0.309***	0.485***	0.523***	0.525***	0.524***	0.492***	0.492***
SEA3	0.181***	0.227***	0.17***	0.145***	0.131**	0.245***	0.234***	0.24***	0.226***	0.283***	0.221***	0.274***	0.23***	0.265***
SEA4	0.159***	0.17***	0.153***	0.162***	0.08*	0.187***	0.196***	0.194***	0.44***	0.473***	0.444***	0.469***	0.476***	0.534***
SEA5	0.212***	0.279***	0.173***	0.145***	0.178***	0.202***	0.314***	0.316***	0.39***	0.437***	0.369***	0.44***	0.374***	0.447***
SEA6	0.299***	0.298***	0.276***	0.145***	0.138***	0.169***	0.224***	0.272***	0.317***	0.326***	0.272***	0.347***	0.306***	0.322***
SEA7	0.24***	0.219***	0.181***	0.119**	0.102**	0.149***	0.228***	0.236***	0.496***	0.495***	0.521***	0.557***	0.527***	0.527***
SEA8	0.206***	0.221***	0.215***	0.128**	0.072*	0.162***	0.247***	0.233***	0.479***	0.463***	0.472***	0.491***	0.491***	0.518***
SEA9	0.149***	0.185***	0.199***	0.138***	0.112**	0.196***	0.215***	0.232***	0.444***	0.506***	0.474***	0.561***	0.445***	0.511***
SEA10	0.168***	0.133***	0.185***	0.114**	0.118**	0.14***	0.231***	0.167***	0.473***	0.447***	0.383***	0.444***	0.455***	0.446***

	EVs7	EVs8	EVs9	SEA1	SEA2	SEA3	SEA4	SEA5	SEA6	SEA7	SEA8	SEA9	SEA10
EBR1													
EBR2													
EBR3													
EBR4													
EBR5													
EBR6													
EBR7													
EBR8													
EVs1													
EVs2													
EVs3													
EVs4													
EVs5													
EVs6													
EVs7	1												
EVs8	0.727***	1											
EVs9	0.557***	0.656***	1										
SEA1	0.362***	0.383***	0.401***	1									
SEA2	0.506***	0.537***	0.532***	0.471***	1								
SEA3	0.223***	0.256***	0.319***	0.479***	0.413***	1							
SEA4	0.507***	0.495***	0.411***	0.416***	0.6***	0.37***	1						
SEA5	0.452***	0.441***	0.362***	0.374***	0.551***	0.422***	0.613***	1					
SEA6	0.36***	0.359***	0.342***	0.374***	0.453***	0.433***	0.482***	0.627***	1				
SEA7	0.559***	0.573***	0.482***	0.456***	0.521***	0.286***	0.583***	0.545***	0.432***	1			
SEA8	0.507***	0.509***	0.417***	0.391***	0.528***	0.329***	0.574***	0.464***	0.466***	0.668***	1		
SEA9	0.466***	0.471***	0.435***	0.386***	0.497***	0.302***	0.576***	0.502***	0.427***	0.702***	0.737***	1	
SEA10	0.423***	0.469***	0.465***	0.373***	0.47***	0.322***	0.506***	0.463***	0.439***	0.605***	0.666***	0.717***	1

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.001$.