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When Do Sustainability Tensions Harm or Benefit Innovation Portfolios? A Paradoxical Perspective

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ABSTRACT

The coexistence of a competitive and sustainability strategy often introduces tensions within organizations. These tensions, if not appropriately managed, can lead to defensiveness and destruction, while they also have the potential to drive creativity and foster sustainability. This study examines how these strategic tensions affect innovation portfolio decision-makers, specifically their decision to select more or less innovative projects. Drawing on paradox theory and innovation management literature, the study investigates the role of contextual factors in moderating the influence of strategic sustainability tensions on portfolio innovativeness. When faced with sustainability tensions, we posit that a firm's entrepreneurial orientation and innovation climate act as contextual factors shaping decisions toward more innovative projects. We test our hypotheses through a multi-informant cross-industry survey of 106 innovation portfolios. Our findings reveal that strategic sustainability tensions are associated with higher portfolio innovativeness only when entrepreneurial orientation and innovation climate are high. Conversely, strategic sustainability tensions are associated with lower portfolio innovativeness when these contextual factors are low. The study adds empirical evidence to organizational context factors in paradox theory and contributes to the literature on innovation portfolio decision-making. Finally, the results add to the importance of sustainability as a strategic orientation in innovation management. Decision-makers are encouraged to recognize and harness strategic tensions in sustainability, fostering an environment where challenges are transformed into opportunities enhancing the portfolio's innovativeness.

1 | Introduction

A sustainability strategy can be “rife with tensions over the legitimacy of such activities within the existing profit-seeking or competitive practices of an organization” (Hengst et al. 2020, 247). Organizations today face mounting pressures to reconcile short-term shareholder value with long-term investments in social and environmental issues. This balancing act highlights

the tension between immediate gains and future goals (Putnam et al. 2016; Slawinski and Bansal 2015). Hengst et al. (2020) identify tensions between (a) sustainable and non-sustainable product features, (b) strategic goals and competitive priorities such as cost efficiency, and (c) organizational and sustainability values. Sustainability tensions can disrupt decision-making and adversely affect corporate entities (Hahn et al. 2015b; Hahn et al. 2014). However, paradoxically addressing such tensions

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Summary

- Innovation portfolio decision-makers perceive sustainability tensions as tensions that arise when a sustainability strategy and a competitive strategy coexist.
- Strategic sustainability tensions lead to selecting more innovative projects in the innovation portfolio only when a high innovation climate and a strong entrepreneurial orientation characterize the organizational context.
- Conversely, strategic sustainability tensions reduce portfolio innovativeness when entrepreneurial orientation and innovation climate are low.
- Managers can proactively shape their organizational context by fostering a strong entrepreneurial orientation and innovation climate, ensuring that sustainability tensions become catalysts for innovation rather than barriers.

may also enhance innovativeness by prompting organizations to adopt unanticipated strategies, leading to innovative outcomes (Hoogendoorn et al. 2020).

As part of the innovation portfolio management process, decision-makers rationally select projects that align with an organization's strategy (Cooper et al. 2002). A portfolio manager aims to achieve an innovation portfolio that is maximized in value, strategically aligned, and well-balanced (Kester et al. 2011; Martinsuo and Killen 2014). Decision-makers experiencing sustainability tension without the appropriate approach or conditions might overlook the potential benefits of these tensions (Sabini and Alderman 2021). Yet, in the dynamic environment of an innovation portfolio, the constant pressure to innovate often requires managers to make decisions quickly and with incomplete information (Kester et al. 2011; Kock and Gemünden 2016). This urgency exacerbates the challenges posed by sustainability tensions, particularly as the advantages of a sustainability strategy tend to manifest in the long term and may be overlooked in the decision-making process (Barney 1991). As a result, projects may disproportionately consist of incremental improvements with limited novelty compared to market or technological advancements (Adams et al. 2015).

On the other hand, sustainability tensions might provide a fertile environment for project portfolios to achieve highly innovative outcomes. Hahn et al. (2015b), 309 explain in a sustainability context that “structural and technological innovations are not based on a dominant design yet.” Thus, opportunities may arise for firms to pursue a first-mover strategy (Albertini 2013). Research on innovation has established that paradoxes are essential for driving innovation (Andriopoulos and Lewis 2009). Successfully addressing the dual imperatives of sustainability and competitiveness may necessitate adopting unconventional approaches. Decision-makers may face project solutions that compel them to embrace higher risks in order to meet these requirements. As a result, the debate continues as to whether sustainability tensions inherently promote incremental or radical innovation (Carmin and de Marchi 2023; Hahn et al. 2015b; Hoogendoorn et al. 2020).

While research has often relied on case studies to explore sustainability tensions (Andriopoulos and Lewis 2009; Carmin and de Marchi 2023), it has not fully assessed the moderating conditions under which these tensions lead to positive or negative outcomes. Hahn et al. (2017, 239) emphasize the need for “a better understanding of the antecedents and boundary conditions of paradoxical responses to sustainability concerns.” It remains unclear which organizational contextual factors enable firms to navigate sustainability tensions positively (Preuss et al. 2021).

Prior studies underscore the relevance of contextual factors in decision-making within innovation portfolios to achieve portfolio innovativeness (Kaufmann et al. 2021; Kock and Gemünden 2021). We argue that firms adopting a specific strategic orientation and supporting norms and values are better equipped to approach strategic tensions. Specifically, we identify the firm's entrepreneurial orientation (EO) and innovation climate as contextual factors that leverage the positive effect of sustainability tensions on portfolio innovativeness. Miller (1983, 771) characterizes a firm with entrepreneurial orientation as “one that engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with ‘proactive’ innovations, beating competitors to the punch.” Further, the innovation climate refers to the support, autonomy, and creative feedback the management gives its employees, encouraging them to pursue innovative tasks (Amabile et al. 1996). EO may enable firms to view sustainability challenges as opportunities for innovation rather than constraints, while a supportive innovation climate fosters open dialogue and creative problem-solving among employees. Without these factors, sustainability tensions may be perceived as risks or obstacles.

Thus, we ask: *How do contextual factors moderate the influence of sustainable strategic tensions on portfolio innovativeness?*

We test our hypotheses using a multi-informant cross-industry survey of 106 innovation portfolios. While there is, on average, no relationship between strategic sustainability tensions and portfolio innovativeness, we find reversing interaction effects. High strategic sustainability tensions are associated with higher portfolio innovativeness only when a strong entrepreneurial orientation and innovation climate exist. Conversely, strategic sustainability tensions are associated with lower portfolio innovativeness when these contextual factors are weak.

This study contributes to the research on managing sustainability and how sustainability tensions can be advantageous, leading to more innovative projects (Hahn et al. 2015b; Hengst et al. 2020). Specifically, it augments prior studies recognizing the positive outcomes of integrating sustainability principles in innovation management (Claudy et al. 2016; Juntunen et al. 2018; Klein et al. 2021). Additionally, the study offers empirical evidence on the role of organizational context factors in paradox theory (Carmin and de Marchi 2023; Hahn et al. 2017; Lewis and Smith 2022). Furthermore, it extends the innovation management literature on contextual factors in innovation portfolio management that influence portfolio innovativeness (Globocnik et al. 2022; Kaufmann et al. 2021; Kock and Gemünden 2016). We recommend that decision-makers identify and acknowledge strategic sustainability tensions and create a

corporate environment that leverages these tensions for competitive advantage (Hahn et al. 2015b).

2 | Theoretical Framework

2.1 | Paradoxical Tensions in Sustainability

Innovations arise when companies can perform explorative and exploitative activities (Tushman and O'Reilly 1996). Those activities often require different conflicting management approaches, creating tensions that firms must deal with (March 1991). Tensions in innovation emanate from various sources relating to the fundamental challenge of firms to concurrently augment their knowledge base while optimizing the utilization of pre-existing knowledge resources (Gebert et al. 2010; Tschang 2007). Scholarly attention has focused on managing these tensions (i.e., to achieve ambidexterity) as they enable firms to simultaneously create radical and incremental innovations (Andriopoulos et al. 2017). But, elucidating the rationale behind how organizations embrace and manage opposing tensions across diverse organizational levels for innovation, scholars have increasingly turned to the insights provided by paradox theory (Smith and Lewis 2011). Paradoxical or opposing tensions are “cognitively or socially constructed polarities that mask the simultaneity of conflicting truths” (Lewis 2000, 761). However, the efficacy of contextual factors in managing paradoxical tensions is contingent upon the specific nature of these tensions (Jules and Good 2014).

The paradox lens is a favorable theory for sustainability issues because organizations face multiple contradictions between sustainability objectives (Schad et al. 2016). Hahn et al. (2017: 237) define the paradox perspective for an organization's sustainability issues as follows: “A paradox perspective on corporate sustainability accommodates interrelated yet conflicting economic, environmental, and social concerns to achieve superior business contributions to sustainable development.”

In their literature review, Carmine and de Marchi (2023) explore various applications of paradox theory within sustainability research. First, they highlight the “detective use,” where researchers employ paradox theory as a theoretical lens to uncover paradoxical tensions. This approach addresses the inherent complexity of such tensions, ultimately shedding light on the most significant challenges of firms or individuals. Conflicts can appear at different organizational levels and in other firm areas. The nature of tensions around sustainability objectives is profound, questioning the underpinning ethos of the organizations (van der Byl and Slawinski 2015). For example, managers and decision-makers face tensions as long-term versus short-term goals (Carollo and Guerri 2018; Etzion et al. 2017), contradictions that emerge when dealing with opposing stakeholder interests (Cuganesan and Floris 2020), or competition over scarce resources (Iivonen 2017).

Second, the “responsive use” focuses on managing tensions at the individual and organizational levels. This application examines strategies and processes for effectively addressing paradoxical tensions (Carmine and de Marchi 2023). Hahn

et al. (2015b) suggest two management strategies for sustainability tensions. On the one hand, they recommend acceptance strategies, in which managers do not try to resolve the paradoxes but spontaneously adapt to address the paradoxical tensions. Similar to the both/and approach, organizations can reap benefits. Oppositely, they further suggest two resolution strategies, namely synthesis and separation. Here, managers try to transform the tensions “into a more manageable situation” (Hahn et al. 2015a, 300). Examples of separation strategies encompass structural solutions akin to those expounded in structural ambidexterity (Hansen et al. 2018), whereby separate organizational units address opposing facets of inherent tensions. Conversely, synthesis strategies manifest as managers aim to bridge opposing tensions. How to manage tensions depends on the area where the tensions occur and on the type of tensions, which is why research on managing tensions relies on case studies (see Carmine and de Marchi (2023). Often, the research employs case studies, discerning the explicit strategies and evaluating their efficacy (Chen et al. 2021; Schrage and Rasche 2021; van Bommel 2018).

The third application of paradox theory in sustainability research is the “sensemaking use.” This approach employs paradoxical thinking or frameworks to explain why individuals or companies behave in specific ways when confronted with sustainable paradoxical tensions (Carmine and de Marchi 2023). Managers' cognitive frames significantly influence how they interpret and respond to sustainability tensions, highlighting why managers often avoid radical changes despite the complexity and ambiguity of sustainability issues (Hahn et al. 2014). Cognitive frames serve as a lens through which managers comprehend a given situation. Here, cognitive frames shape managers' awareness of tensions when formulating a strategic response (Smith and Tushman 2005). In turn, managers can also influence employees' cognitive frames and perceptions. Unexpected occurrences can also impact the temporal perception of actors, redirecting attention from long-term objectives to immediate concerns (Sharma and Jaiswal 2017). Team research informs us that a paradoxical mindset (human factor) can be a positive trigger to manage tensions properly and lead to higher team innovation performance (Miron-Spektor et al. 2011).

It remains unclear how companies can create an organizational context to bring about and support these action cycles. Preuss et al. (2021) point out that literature on contingencies intensifying responses to sustainability tensions is still scarce. In a case study, Hunoldt et al. (2018) identified organizational characteristics that influenced the intensity of coping mechanisms with tensions in corporate social responsibility. The authors distinguish indirect effects, such as ownership structure, which affects the perceived complexity of the tension, and direct impact, such as managers' commitment, which directly influences coping strategies. On a conceptual level, there are already approaches to contextual factors to manage paradoxical tensions in sustainability, such as the influence factor of organizational agility (Ivory and Brooks 2017). As we know from the general paradox literature, contextual factors are essential to navigating the paradox (Lewis and Smith 2022). However, these contextual factors that lead individuals, teams, and organizations to embrace paradoxical decisions remain little explored in sustainability research.

2.2 | Innovation Portfolio Management and Its Context

Innovation portfolio management (IPM) is a decision-making process of selecting, prioritizing, and allocating resources to innovation projects to retain a competitive advantage in dynamic environments (Cooper et al. 1999; Kester et al. 2011). Its primary objective is to maximize the innovation portfolio's value through a well-balanced and strategically aligned set of projects (Kock and Gemünden 2021; Martinsuo and Killen 2014). The innovation portfolio is essential for strategy implementation because it connects strategy and operational projects and, thus, largely determines a firm's future business (Clegg et al. 2018; Kopmann et al. 2017; Meskendahl 2010).

The literature on sustainability in innovation portfolio management is scarce. Existing research on sustainability in innovation management explores the effects of sustainability orientation on various outcomes, such as business model innovation or product success (Claudy et al. 2016; Du et al. 2016; Juntunen et al. 2018; Klein et al. 2021; Paparoidamis et al. 2019). A sustainability orientation is consistently associated with positive outcomes in this research area, indicating its beneficial impact. Other scholars draw attention to product-service systems that promote sustainable customer behavior. Still, the sustainability benefits remain limited because inherent paradoxical tensions between marketability and achieving substantive sustainability hinder progress (Hahn and Pinkse 2022). This finding challenges the overly simplistic assumption that sustainability directly translates into business benefits. In the context of portfolio management, research has largely focused on providing practical guidance for managers, such as measuring and integrating sustainability into the portfolio (Aghajani et al. 2023; Hallstedt et al. 2010). However, there are no studies on sustainable tensions in innovation portfolio management to date, which is why we will focus on decision-making processes and contextual factors in general within IPM in the following.

In IPM, the selection of projects is a multidimensional decision-making process comprising numerous concurrent decisions. Thus, it is evident that the ability to make effective decisions is a significant determinant of success, leading researchers to seek an understanding of the factors that contribute to decision-making efficacy (Kester et al. 2014; Kock and Gemünden 2016). Moreover, research suggests that nonrational, political behavior significantly influences these decision-making processes, highlighting that managers' behaviors and perceptions of the environment notably impact portfolio decisions (Röth et al. 2019). In addition to objective, data-driven decision-making, researchers have highlighted the significance of cultural factors in decision-making processes (Kester et al. 2011).

Kaufmann et al. (2021) argue that the strategic and cultural context in IPM shapes decision-making. The authors see a firm's strategic orientation (here, entrepreneurial orientation) as an essential strategic contextual factor because it provides top-down guidance for IPM decision-makers. In addition, an organization's innovation climate represents a significant cultural contextual factor because it shapes IPM actors' attention bottom-up. Several studies on IPM empirically support the importance of strategic orientation (Kaufmann et al. 2021; Kock and Gemünden 2021;

Meskendahl 2010; Salomo et al. 2008) and innovation climate (Kaufmann et al. 2021; Kock and Gemünden 2016; Kock et al. 2015).

We conceptualize the two context factors from IPM research as representative contextual factors for managing strategic tensions in sustainability. Entrepreneurial orientation serves as a guardrail that enables decision-makers to support complex thinking in their organization. An innovation climate fosters an environment where creativity thrives and novel solutions emerge. Therefore, it can advance the dynamics in an innovation portfolio of all stakeholders to deal with complex situations like sustainability tensions.

2.2.1 | Entrepreneurial Orientation

Three features define an entrepreneurially oriented firm: *innovativeness, proactiveness, and risk-taking*. Covin and Slevin (1989) further clarified the three dimensions and developed a concept that describes a firm's strategic posture, reflecting these three dimensions. To date, this conceptualization is dominant in entrepreneurship and innovation research. Innovativeness means firms favor innovation while regularly questioning their current business models and products. Proactiveness describes a firm's willingness to obtain a first-mover position by proactively seeking new trends and information in the market (Zhou et al. 2005). Therefore, proactiveness is a strong driver for innovativeness in new product development (Talke et al. 2011). Lastly, risk-taking behavior designates firms that are not afraid to make bold moves, engaging risks when identifying an opportunity to gain a possible competitive advantage (Lumpkin and Dess 1996). Entrepreneurial orientation is not only a critical antecedent to firm performance, as confirmed by meta-analyses (Rauch et al. 2009; Rosenbusch et al. 2011). Several studies have also shown that it is a relevant contingency factor in innovation portfolio decision-making (Kaufmann et al. 2021; Kock and Gemünden 2021).

2.2.2 | Innovation Climate

The innovative climate in the firm plays an essential role in developing creative ideas (Scott and Bruce 1994). According to Amabile et al. (1996), employees are more creative in an environment emphasizing freedom and autonomy and providing sufficient resources. Further, managers should encourage and value employee idea generation. Consequently, employees can develop ideas freely and are motivated to contribute to them without reprimanding. It is accompanied by employees feeling safe to express and discuss their thoughts even if not everyone in the team shares the same view (Anderson and West 1998). Previous research showed that the innovation climate is essential in IPM decision-making (Kaufmann et al. 2021; Kock and Gemünden 2021).

3 | Hypotheses

We present our conceptual framework in Figure 1. First, we hypothesize that a firm's entrepreneurial orientation as strategic

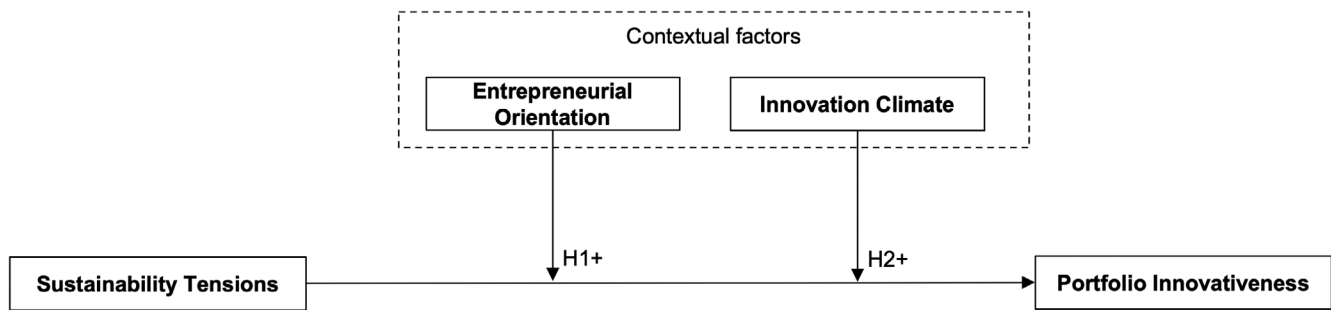


FIGURE 1 | Conceptual framework.

posture positively moderates the relationship between sustainability tensions and a portfolio's innovativeness. Second, we hypothesize that innovation climate is a positive moderator for the effect of sustainability tensions on portfolio innovativeness.

3.1 | The Moderating Influence of Entrepreneurial Orientation

We hypothesize that a firm's entrepreneurial orientation strengthens the positive relationship between sustainability tensions and portfolio innovativeness. Entrepreneurial-oriented firms possess skills to help IPM deal with paradoxical problems and view tensions not as constraints but as opportunities for innovation.

The literature emphasizes EO's role in shifting decision-makers' attention toward more innovative options, positioning it as a key contextual factor that enhances portfolio innovativeness (Kaufmann et al. 2021). EO also reframes sustainability tensions as opportunities for innovation rather than trade-offs to resolve (Jansson et al. 2017). Highly entrepreneurial-oriented firms leverage these tensions to their advantage, as outlined in the following.

First, EO supports firms in prioritizing sustainability strategies even when they conflict with competitive goals. Hengst et al. (2020) identify tensions between values, such as when firms choose sustainable practices over immediate financial gains. EO fosters innovativeness through dramatic changes and proactiveness by championing new approaches (Klein et al. 2021; Kock and Gemünden 2021). In the context of IPM, EO can initially lead decision-makers to sacrifice competitive values to pursue sustainability goals. However, this approach can yield long-term advantages. For example, a firm might eliminate environmentally harmful materials from its products, incurring short-term costs but gaining a competitive edge when such materials face regulatory bans. EO provides the confidence and strategic foresight necessary to legitimize these sacrifices as forward-thinking investments.

Second, EO helps firms manage tensions between sustainability and competitive objectives. As Smith and Lewis (2011, 393) argue, fostering "creativity and learning" alongside "flexibility and resilience" allows firms to address paradoxical tensions effectively. Firms pursuing economic and environmental/social objectives are often at risk of "unintended consequences, as a solution to one problem may be detrimental to another" (Hahn

et al. 2015b, 298). For example, a firm may aim to reduce its environmental footprint by implementing socially and environmentally responsible supply chains while simultaneously striving for faster market entry to secure first-mover advantages or meet customer delivery expectations. Hengst et al. (2020) describe managing these tensions by integrating sustainability and competitive strategies into action.

To address these challenges, firms can adopt a collaborative approach by working closely with suppliers to develop sustainable solutions. Although this may involve initial risks, such as higher upfront costs or uncertainties in supplier collaboration, it can yield long-term benefits. EO enables decision-makers to embrace such risks and prioritize innovation portfolio projects incorporating sustainable supply chains. Instead of frequently switching suppliers to maximize short-term gains, entrepreneurial-oriented firms focus on long-term outcomes, such as co-developing sustainable processes or materials with suppliers. Through such collaborations, firms meet sustainability goals and achieve cost savings and competitive advantages.

In summary, entrepreneurial-oriented firms enable decision-makers to accept and manage sustainability tensions, leading to more innovative projects. Thus, we posit:

H1. *Entrepreneurial orientation positively moderates the relationship between strategic sustainability tensions and portfolio innovativeness, so strategic sustainability tensions increase (decrease) portfolio innovativeness when entrepreneurial orientation is high (low).*

3.2 | The Moderating Influence of Innovation Climate

An innovation climate is necessary to engage employees in the innovation process. We expect the innovation climate to positively moderate the relationship between sustainability tensions and portfolio innovativeness. This environment encourages the decision-makers and employees to use sustainability tensions as drivers in identifying the aspects of opposition, interrelation, and persistence within those tensions.

Empirical studies demonstrated that innovation climate improves decision-making quality in innovation portfolios (Kock and Gemünden 2016), product quality in resource-constrained innovation projects (Weiss et al. 2011), front-end

innovation performance (Bertels et al. 2011; Kock et al. 2015), and portfolio innovativeness (Kaufmann et al. 2021). Tensions in sustainability can cause discussions within the portfolio. Hahn et al. (2015b, 303) state that “[a] manager who nonetheless pursues sustainability objectives that deviate from the organisational agenda thus risks facing disapproval by the organisation.”

First, sustainability tensions arising from conflicting product features can constrain the innovation portfolio. These tensions require decision-makers and employees to adjust strategies by compromising on product features, re-evaluating the resulting trade-offs, or splitting the conflicting features into separate portfolio expansion projects (Hengst et al. 2020). Decision-makers must work closely with employees to provide transparent and accurate reporting of all relevant details to devise a course of action for such conflicting product features. In a strong innovation climate, decision-makers foster transparency and open dialogue, enabling employees to address these conflicts openly rather than concealing or avoiding them. Within a dynamic equilibrium, “the role of leadership is to support opposing forces and harness the constant tension between them, enabling the system to not only survive but continuously improve” (Smith and Lewis 2011, 386). Leaders’ behavior can (a) help lower-level managers make paradoxical tensions salient by shaping their context (Knight and Paroutis 2016) and (b) foster discussions that support debates and openness. For example, consider the development of a new product line within the innovation portfolio that incorporates new environmentally friendly packaging. While biodegradable materials may align with sustainability goals, they might lack the durability of traditional plastics, potentially leading to product damage during transport. Decision-makers need to collaborate closely with R&D and logistics teams, who should be transparent about the limitations and benefits of available packaging options, to manage this tension effectively. In a supportive innovation climate, team members can openly discuss these challenges, such as balancing customer satisfaction with environmental goals, without fear of reprisal. An innovation climate is therefore essential to encourage highly innovative approaches and decide on the right strategy for managing the tensions between conflicting product attributes.

Second, Weiss et al. (2011, 200) found that an innovation climate enabled innovation teams to manage financial resource constraints better and ultimately improve product quality. They argue that a team innovation climate overcomes “barriers of capability” by fostering the development of innovative approaches to address capacity scarcity and “barriers of will” by encouraging supportive and open-minded employees who are willing to take risks. Similar barriers can arise from sustainability constraints. Employees may feel unprepared or unable to adopt new, more sustainable processes or materials due to a perceived lack of skills or expertise (Hahn et al. 2015b). Additionally, without a strong innovation climate, employees might hesitate to openly discuss these challenges or fail to recognize the potential for overcoming them through creative problem-solving approaches. Thus, we argue that constraints stemming from sustainability tensions can drive innovative outcomes when paired with an innovation climate that fosters a psychologically safe environment. In such an environment,

employees feel encouraged to exchange ideas, propose solutions, and explore new possibilities without fear of judgment or failure.

In conclusion, discussions and constraints triggered by sustainability tensions can generate innovative ideas only under the right circumstances. A strong innovation climate serves as a critical enabler, transforming sustainability tensions into opportunities for portfolio innovativeness. This leads to our second hypothesis:

H2. *Innovation climate positively moderates the relationship between strategic sustainability tensions and portfolio innovativeness, so strategic sustainability tensions increase (decrease) portfolio innovativeness when innovation climate is high (low).*

4 | Methodology

4.1 | Sample

We use a cross-industry sample of innovation portfolios (unit of analysis) to test our hypotheses. Our unit of analysis is decision-makers, investigating their behavior on perceived sustainability tensions, whereas the level of analysis is the innovation portfolio. We contacted 500 organizations with portfolios of at least 20 simultaneously running projects. We targeted three types of informants per portfolio that answered our survey. First is a decision-maker (e.g., C-level manager, head of R&D, or division head) with decision-making authority to select and terminate the innovation portfolio's projects. The second is a portfolio coordinator responsible for managing the innovation portfolio with a good overview of the portfolio processes. Typical job titles of the coordinator were innovation manager, head of PMO, or senior manager. Third, we surveyed multiple project managers leading some of the innovation portfolio's projects. The multi-informant design reduces possible common method bias (Podsakoff et al. 2003) as the coordinator assesses the endogenous variable and the senior manager and project managers assess the exogenous variables. Our response rate was 25%. However, we could only use portfolios with answers from all informants as they evaluated the different variables in our model. We had answers from 125 innovation portfolios, but six portfolios only had decision-maker responses, and 13 portfolios only had coordinator responses. Therefore, the final sample comprises 552 responses from 106 innovation portfolios with an average of 5.2 respondents per portfolio (106 decision-makers, 106 portfolio managers, and 340 project managers). We provide other sample characteristics in Table 1 (i.e., distribution of industry, employees, portfolio budget, and revenue).

4.2 | Measurement

We used multi-item measurement scales to assess the variables. We derived the constructs from the literature except for sustainability tensions. Here, we designed our items following Hengst et al. (2020) qualitative concept of strategic tensions. If not otherwise stated, we used seven-point Likert scales ranging from 1 (“strongly disagree”) to 7 (“strongly agree”). We applied confirmatory factor analysis (CFA) to evaluate the scales’

TABLE 1 | Sample characteristics.

Industry		Employees	
Mechanical and vehicle engineering	12.26%	< 500	24.53%
Electronics/ICT	14.15%	500–2000	24.53%
Banks/insurances	23.58%	> 2000	50.94%
Traffic/transport/logistics/construction	7.55%		
Chemistry/pharma	6.60%		
Healthcare	5.66%		
Other	30.20%		
Revenue		Portfolio budget	
< 100 M EUR	18.87%	< 10 M EUR	16.04%
100–500 M EUR	20.75%	10–30 M EUR	22.64%
501–2000 M EUR	10.38%	30–100 M EUR	26.41%
> 2000 M EUR	50.00%	> 100 M EUR	34.91%

validity. We measured Cronbach's Alpha, the average variance extracted, and composite reliability for scale reliability (Ahire and Devaraj 2001). We used several measures from Chan (1998) and Podsakoff et al. (2003) to reduce common method bias. Most importantly, we used different informants for the independent and dependent variables. The Appendix A lists all items' wordings and the CFA results (which include reliability scores and the item's loadings).

4.2.1 | Dependent Variable

Portfolio innovativeness is an established measure from former literature, which we slightly adapted to our context (Kaufmann et al. 2021; Schultz et al. 2013; Talke et al. 2011). We operationalized portfolio innovativeness as a second-order construct that consists of two dimensions. Market innovativeness ($\alpha = 0.798$) describes how new the product or project results are to the market. Technological innovativeness ($\alpha = 0.872$) describes how new the technologies are the organization uses in their products or projects. The portfolio coordinator assessed this variable.

4.2.2 | Independent Variable

We operationalized *strategic sustainability tensions* with three items following the developed theoretical framework from Hengst et al. (2020). Here, they differentiate tensions between a competitive strategy and a sustainability strategy into three dimensions: tensions between product features, tensions between values, and tensions between goals. We adapted those dimensions to the innovation portfolio setting but maintained the basic ideas behind those dimensions. Instead of tensions between product features, we asked for tensions between attributes of the portfolio's projects. We could stick to the

wording of goals and values described in the theory developed by Hengst et al. (2020). Portfolio decision-makers assessed the variable ($\alpha = 0.768$).

4.2.3 | Moderators

We measured *entrepreneurial orientation* by taking the widely used scale from Covin and Slevin (1989), which consists of three dimensions: innovativeness, proactiveness, and risk-taking. For each dimension of entrepreneurial orientation, we used three items for assessment. Overall, we aggregated the nine items into one second-order construct. Decision-makers assessed the entrepreneurial orientation of the organization as the construct relates to the overall strategic composition of the firm. The second moderator, *innovation climate*, consists of four items and describes how the organization encourages employees to think creatively and have open debates (Kaufmann et al. 2021; Kock and Gemünden 2016). To assess the climate, we averaged the answers from project managers and the portfolio coordinator because the climate directly addresses lower-hierarchy employees' openness and psychological safety ($\alpha = 0.873$). By integrating responses from project managers, we strived for a more objective assessment.

4.2.4 | Control Variables

We considered several control variables as they might influence the independent or dependent variable. We included the natural logarithm of the annual *portfolio budget* in a million Euros as more budget enables companies to invest in more R&D expenditures and might influence the innovativeness of the portfolio. Further, we included the portfolio management *formalization* ($\alpha = 0.888$) as a four-item construct taken from prior literature (Kock et al. 2024; Teller et al. 2012). Formalized portfolios might have fewer sustainability tensions as they are more mature in their processes and already integrated sustainability holistically. Portfolio coordinators assessed the variable. *Stakeholder pressure* describes the pressure different sources exert on the firm to implement sustainability. We took the measurements from Wijethilake and Lama (2019) and adapted them slightly to our context. We asked how much pressure the following sources exert on their firm to implement sustainability: customers and society, government and regulatory bodies, shareholders, and competitors. Stakeholder pressure is a composite formative construct due to multiple reasons fulfilling the definitional criteria by Jarvis et al. (2003). A change in one of the items does not directly indicate a change in another item but still influences the overall value of the construct. Further, the items can have different antecedents and outcomes. For example, exerting competitors' pressure on the firm does not directly mean that the pressure from governmental bodies will increase. Also, pressure from competitors possibly has other motivations (antecedents) than one of the regulatory bodies. Lastly, by excluding an item, we would change the meaning of the construct as the construct comprehensively maps an organization's stakeholders for the topic of sustainability (Wijethilake and Lama 2019). We controlled for *technology and market turbulence* by taking the established measurements from Sethi and

TABLE 2 | Descriptives and correlations.

Variables	<i>M</i>	<i>SD</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Portfolio budget	3.75	1.78									
(2) Formalization	4.83	1.73	0.17								
(3) Technology turbulence	4.99	1.14	−0.04	0.22							
(4) Market turbulence	3.71	1.15	−0.21	−0.01	0.54						
(5) Strategic control	3.47	1.55	0.05	0.44	0.04	−0.11					
(6) Portfolio innovativeness	3.89	1.11	0.15	−0.04	0.27	0.33	0.11				
(7) Sustainability tensions	3.96	1.2	−0.02	−0.16	−0.01	0.10	−0.06	0.18			
(8) Entrepreneurial orientation	3.98	0.89	0.14	0.02	0.44	0.38	−0.07	0.30	0.12		
(9) Innovation climate	5.02	0.83	0.10	0.27	0.19	0.23	0.25	0.32	0.11	0.29	
(10) Stakeholder pressure	4.87	0.89	0.28	0.28	0.13	0.09	0.06	0.20	0.08	0.16	0.23

Note: $n = 106$, M = mean, SD = standard deviation, all correlations above 0.2 are significant at the 5%-level.

Iqbal (2008). Technology turbulence ($\alpha = 0.806$) and market turbulence ($\alpha = 0.763$), each consists of three items describing the changes in the industry regarding technology and the market, respectively. We wanted to differentiate between stakeholder pressure and an overall turbulent environment as we argued our hypothesis specifically on pressure, not just a turbulent environment. Further, companies in turbulent environments tend to innovate to maintain a competitive advantage. Decision-makers assessed the variable. Additionally, we controlled for the *strategic control* ($\alpha = 0.922$) of projects, which describes the extent to which portfolio management reviews the fit between projects and a portfolio's strategy while at the same time regularly questioning the strategy. We used three items from former literature, and portfolio coordinators assessed the variable (Bechtel et al. 2022; Kopmann et al. 2015). Strategic control might influence the strategic sustainability tensions as portfolios with pronounced strategic control might be more aware of tensions but might also be better at coping with them. Decision-makers assessed the variable. We present the correlations and statistics in Table 2.

5 | Results

We test our hypotheses using hierarchical ordinary least squares (OLS) regression with interaction effects. Table 3 presents the analysis and results. Model 1 shows the effects of the control variables on portfolio innovativeness. We can see that portfolio budget ($b = 0.126$; $p = 0.036$), formalization ($b = -0.150$; $p = 0.028$), market turbulence ($b = 0.295$; $p = 0.006$), and strategic control ($b = 0.159$; $p = 0.027$) are and remain significant throughout the models. Technology turbulence and stakeholder pressure have no significant relationship with innovativeness. Model 2 includes sustainability tensions that do not significantly relate to portfolio innovativeness ($b = 0.113$; $p = 0.175$), as we assumed in our theoretical framework. In Model 3, we add the moderating variables and find no direct relationship between entrepreneurial orientation and portfolio innovativeness but between innovation climate and portfolio innovativeness ($b = 0.266$; $p = 0.047$). In Model 4, we test the interaction term between sustainability

tensions and entrepreneurial orientation on portfolio innovativeness. We find a positive coefficient ($b = 0.218$; $p = 0.031$), confirming Hypothesis 1. Model 5 shows the positive interaction effect of sustainability tensions and innovation climate on innovativeness ($b = 0.221$; $p = 0.034$). Therefore, we can also confirm Hypothesis 2.

To better interpret our results, we plotted sustainability tensions' marginal effects for different levels of innovation climate or entrepreneurial orientation (see Figure 2, left side). Further, we plotted the interaction effects as simple slopes (see Figure 2, right side). The diagrams show the relationship between sustainability tensions and portfolio innovativeness for a low value of the moderator (gray dashed line) and a high value of the moderator (black line). A low (high) value describes the mean of the moderator minus (plus) one standard deviation. Both diagrams show that sustainability tensions are only positively associated with portfolio innovativeness when the moderator is highly pronounced. It suggests that the respective contextual factor enables project portfolios to embrace sustainability tensions better and develop innovative solutions in their project portfolio. If the two moderators are low, we see a negative relationship between tensions and portfolio innovativeness.

To rule out other explanations, we tested different alternatives. First, it could also be that the experienced tensions depend on the industry. Some industries already focusing on sustainability concerns (e.g., the energy sector) may not experience the same tensions between their competitive and sustainability strategy. Due to our sample size, incorporating a categorical variable with seven industries (see Table 1) is not feasible. Thus, we included the stakeholder pressure as a proxy for the industry. We further tested with a one-way analysis-of-variance (ANOVA) if there are significant differences between sustainability tensions among industries. The ANOVA was not significant between industries ($p = 0.930$). Therefore, not integrating industries as a control variable is acceptable.

Second, it could also be that companies with an established sustainability orientation exhibit fewer tensions and,

TABLE 3 | Regression results.

	Portfolio innovativeness				
	(1)	(2)	(3)	(4)	(5)
Portfolio budget (ln)	0.13*	0.13*	0.11+	0.11+	0.11+
	[0.04]	[0.03]	[0.08]	[0.07]	[0.06]
Formalization	−0.15*	−0.13+	−0.15*	−0.15*	−0.13+
	[0.03]	[0.05]	[0.03]	[0.03]	[0.06]
Technology turbulence	0.13	0.13	0.11	0.12	0.09
	[0.24]	[0.21]	[0.32]	[0.25]	[0.43]
Market turbulence	0.29**	0.28**	0.21*	0.23*	0.23*
	[0.01]	[0.01]	[0.05]	[0.04]	[0.03]
Strategic control	0.16*	0.16*	0.13+	0.13+	0.12+
	[0.03]	[0.03]	[0.07]	[0.07]	[0.08]
Stakeholder pressure	0.18	0.16	0.13	0.15	0.11
	[0.13]	[0.18]	[0.27]	[0.19]	[0.37]
Sustainability tensions		0.11	0.09	0.06	0.08
		[0.18]	[0.29]	[0.48]	[0.32]
EO			0.10	0.11	0.09
			[0.46]	[0.38]	[0.46]
Innovation climate			0.27*	0.23+	0.23+
			[0.05]	[0.08]	[0.09]
Sustainability tensions×EO				0.22*	
				[0.03]	
Sustainability tensions×innovation climate					0.22*
					[0.03]
Constant	0.97	1.03	1.08*	1.52*	1.84*
	[0.16]	[0.14]	[0.02]	[0.05]	[0.02]
R-squared	0.23	0.24	0.28	0.32	0.32
Adjusted R-squared	0.18	0.19	0.22	0.25	0.24
F	4.86	4.46	4.20	4.41	4.39

Note: OLS regression; *n* (project portfolio)=106; independent variable and moderators are mean-centered; + > 0.1; **p* < 0.05; ***p* < 0.01; *p* value in brackets.
Abbreviation: EO=entrepreneurial orientation.

fundamentally, are more innovative as they can react quickly to new circumstances in terms of sustainability (Claudy et al. 2016; Klein et al. 2021). Consequently, we conducted another analysis that included strategic sustainability orientation¹ as a control variable and still found support for both hypotheses. We will discuss our findings in the following section.

6 | Discussion

Firms increasingly introduce sustainability strategies due to rising external pressure and the possibility to innovate, ultimately

gaining a competitive advantage (Claudy et al. 2016; Klein et al. 2021). Tensions between the newly introduced sustainability strategy and the established competitive strategy can arise. Hengst et al. (2020) identified three dimensions of contradicting product features, values, and goals. In this article, we empirically investigated the relationship between sustainability tensions and portfolio innovativeness, considering the organizational context of innovation portfolios, specifically entrepreneurial orientation and innovation climate.

The effect of sustainability tensions on portfolio innovativeness depends on the organizational context, which managers

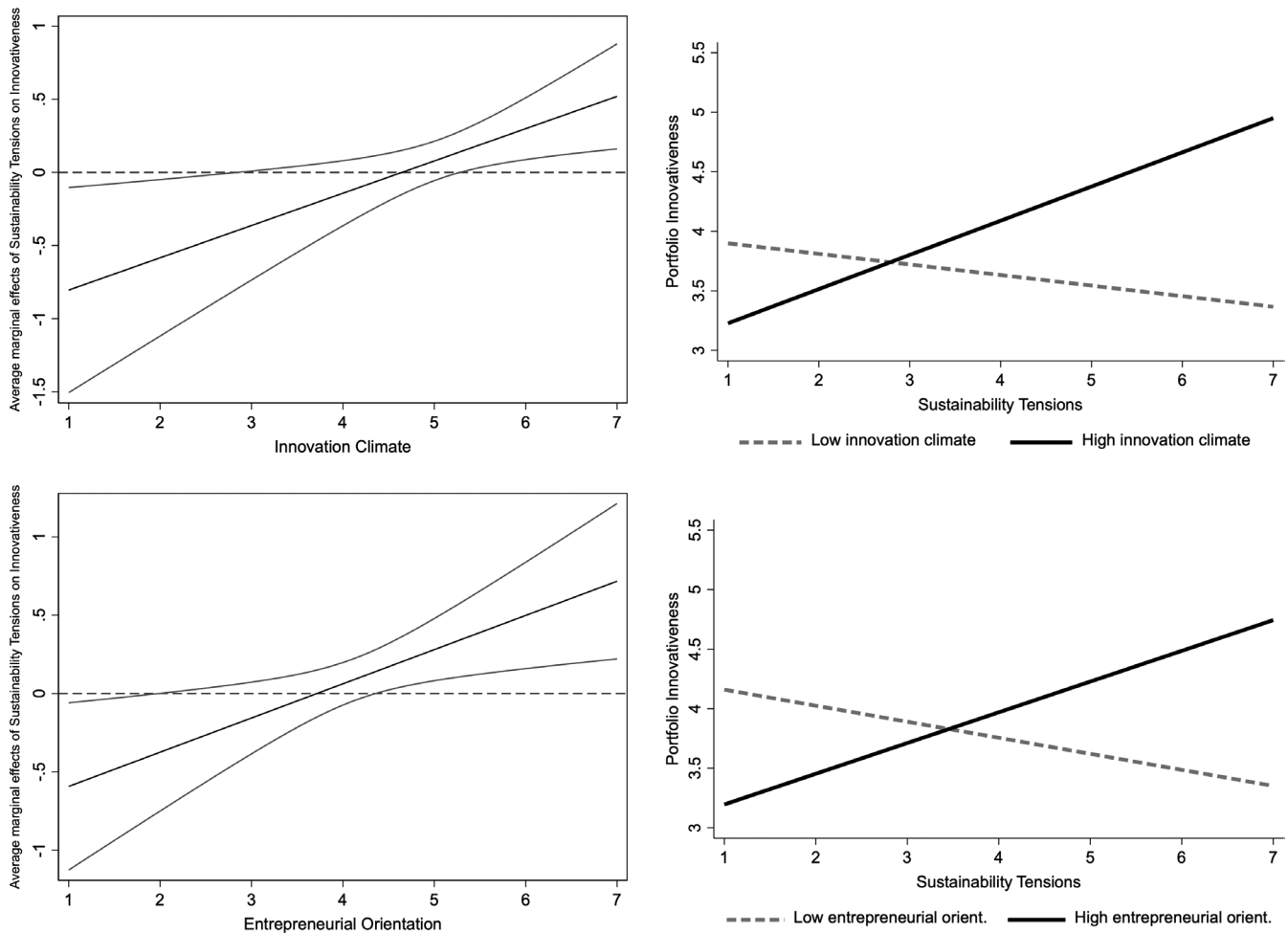


FIGURE 2 | Left side: Marginal effects of sustainability tensions on portfolio innovativeness for different levels of innovation climate or entrepreneurial orientation (gray lines represent 90% confidence bands). Right side: Simple slopes of the relationship between sustainability tensions and portfolio innovativeness with high/low innovation climate or entrepreneurial orientation.

can influence through their behavior. Sustainability tensions can occur and be perceived at different levels, like the individual or organizational level. Former research argued that sustainability tensions can also be disadvantageous as decision-makers and employees may face conflicting goals that seem intractable (Hahn et al. 2014). The newly introduced sustainability goals might be incompatible with the competitive goals of a firm. These tensions can overwhelm employees and possibly lead to incomprehension (Miron-Spektor et al. 2011). The perceived tensions may lead decision-makers to opt for incremental innovations due to the conflicting situations. But, “[t]ensions are [...] productive because they enable actors to work toward legitimation of both strategies in action, which reinforces their co-enactment at the organizational level” (Hengst et al. 2020, 265).

Our study quantitatively supports that sustainability tensions can make companies more innovative (Hahn et al. 2017). High levels of entrepreneurial orientation strengthen the relationship between sustainability tensions and portfolio innovativeness. Managers are enabled to take on the risks necessary for selecting innovative projects. Additionally, they perceive risks associated with a sustainability strategy more accurately and

can anticipate them. However, the results demonstrate that, with low levels of entrepreneurial orientation, managers might no longer be able to use the perceived tensions to their advantage and are prone to more incremental innovations. They may be more cautious and adopt a slow approach, triggered by low proactivity and risk awareness (Hahn et al. 2014). We demonstrate that a pronounced innovation climate strengthens the relationship between sustainability tensions and innovativeness. An innovation climate allows employees at all hierarchical levels to engage in open discussions and express their creativity (Kock et al. 2015). An innovation climate can help lower barriers for employees to cope with new situations (Weiss et al. 2011). If this climate is not present in the portfolio, employees may be less encouraged to think outside the box, which could lead to fewer innovative project proposals. Consequently, the range of options available to decision-makers is constrained, ultimately reducing the level of innovation within the portfolio.

Lastly, the results indicate that sustainability tensions, on average, do not inherently affect portfolio innovativeness. We see no relationship on average because tensions can be interpreted as an opportunity or threat. Whether these tensions

drive decision-makers toward more or less innovative projects depends on the organizational context. A high entrepreneurial orientation or a supportive innovation climate increases the likelihood that tensions will be viewed as opportunities, encouraging the selection of more innovative projects.

6.1 | Theoretical Implications

In response to calls from paradox theory to identify contextual factors (Lewis and Smith 2022; Preuss et al. 2021) and, more specifically, from sustainability research to successfully manage sustainability tensions (Hahn et al. 2015b; Hengst et al. 2020), this article explores when these tensions can contribute to decisions regarding more innovative projects. Specifically, we contribute to managing paradoxical tensions through context, decision-making in IPM, and sustainability as a further strategic orientation that plays a vital role in innovation management.

First, prior research highlights that effectively managing paradoxical tensions can yield positive outcomes, such as enhanced creativity (Schad et al. 2016), team innovation (Gebert et al. 2010), and organizational ambidexterity (Andriopoulos and Lewis 2009). However, empirical studies providing quantitative evidence on the contextual factors enabling such outcomes, particularly in the domain of sustainability, remain scarce. Our findings address this gap by demonstrating how EO and innovation climate support decision-makers in transforming sustainability tensions into opportunities for innovation. By linking these contextual factors to the productive management of tensions, we expand paradox theory, emphasizing that the ability to leverage tensions depends not only on individual cognitive strategies but also on the broader organizational context (Hengst et al. 2020; Hunoldt et al. 2018; Miron-Spektor et al. 2011). Furthermore, this study underscores the dynamic nature of sustainability tensions, suggesting that they do not inherently lead to innovation. Instead, their impact is contingent upon the organizational and strategic context.

Second, we contribute to the literature on IPM. Decision-making within IPM often involves navigating complex trade-offs between competing objectives. Our study highlights that EO and innovation climate shape portfolio decision-makers' interpretations of sustainability tensions, which, in turn, influence their choices to favor more or less innovative projects. In doing so, we expand the findings of Kaufmann et al. (2021) by empirically validating EO as a contextual factor that promotes portfolio innovativeness, particularly in the face of sustainability challenges. Therefore, we add to the literature on contextual factors influencing a portfolio's innovativeness (Globocnik et al. 2022; Kock and Gemünden 2016). Additionally, we complement existing literature on formal and informal decision-making in IPM. We demonstrate how contextual factors such as EO and innovation climate allow decision-makers to balance adherence to formal decision-making protocols with the flexibility needed to leverage sustainability tensions for innovation, thus broadening the understanding of informal decision-making

in IPM (Martinsuo 2013; Röth et al. 2019). By encouraging decision-makers to view sustainability tensions as opportunities rather than constraints, these contextual factors enable a more diverse and innovative portfolio, broadening the scope of decision-making frameworks in IPM.

Lastly, we respond to the call for further research on strategic orientations and strategies regarding sustainability in innovation management (Klein et al. 2021). Former research demonstrated that an orientation toward sustainability positively relates to an organization's NPD success (Claudy et al. 2016; Du et al. 2016) or its innovation activity (Hoogendoorn et al. 2020; Klein et al. 2021). So far, this literature has only considered whether sustainable values are essential for the firm. Still, it neglected how these values translate into a strategy and whether they conflict with a competitive strategy. We demonstrate that managing strategic tensions with high levels of EO and innovation climate enhances portfolio innovativeness. This finding clarifies the mechanisms through which decision-makers can integrate sustainability strategies into existing structures, advancing our understanding of how firms reconcile sustainability goals with competitive pressures. By providing quantitative evidence, we extend the qualitative work of Juntunen et al. (2018), who identified deep organizational engagement as a prerequisite for effective sustainability strategies. Our results emphasize that sustainability tensions can be leveraged as a source of creativity and innovation when supported by the proper organizational context. Therefore, we provide empirical evidence on the consequences of strategic sustainability tensions to the growing field of sustainability in innovation management (Claudy et al. 2016; Juntunen et al. 2018; Klein et al. 2021).

6.2 | Managerial Implications

Managers can draw several implications from this study. First, managers should know that tensions must be salient before managing them. Here, an innovation climate can support the constant exchange between portfolio stakeholders to identify emergent tensions. Further, a pronounced innovation climate helps develop ideas for managing the tensions. Therefore, decision-makers and portfolio coordinators should take the necessary steps to strengthen the innovation climate. For example, they can set up a project manager community because some innovation project managers might have no experience with sustainability issues. A project manager community enhances the exchange of experiences among project managers, supporting an open atmosphere because higher hierarchical employees are absent.

Decision-makers could collaborate with project managers to conduct informal reporting on sustainability indicators of innovation projects (Sabini and Alderman 2021). This approach helps dismantle hierarchical barriers and foster informal exchange, creating an innovation climate. Additionally, it enables project managers to share ideas on measuring sustainability or addressing potential tensions while enhancing their engagement by providing direct access to top management (i.e., decision-makers).

To encourage decision-makers to embrace entrepreneurial orientation, organizations can allocate specific budgets to distinct strategic buckets that prioritize sustainability initiatives, especially when these projects involve higher levels of risk (Hutchison-Krupat and Kavadias 2015). By explicitly dedicating resources to these buckets, firms create a structured approach to support projects that align with long-term environmental and social goals while fostering a culture of calculated risk-taking. Additionally, to enhance entrepreneurial orientation and promote a strong innovation climate, firms should implement employee idea competitions as part of the innovation portfolio process. Winning ideas can receive dedicated funding and resources, demonstrating the organization's commitment to implementing employee-driven innovations.

However, we want to remind decision-makers that tensions can also harm a portfolio's innovativeness and, eventually, performance if the identified contextual factors (i.e., innovation climate and entrepreneurial orientation) are weak. Here, portfolio stakeholders might not manage tensions correctly, which is detrimental because the tensions might not become salient, and other portfolio stakeholders perceive tensions negatively.

6.3 | Limitations and Future Research

This study has limitations that need to be considered when interpreting the results, but it also provides directions for future research. First, our sample consists of European companies. However, cultures in other countries besides Europe might differ in managing paradoxical tensions. Keller et al. (2017) found that differences in paradoxical framing and mindset appear under specific conditions because of different cultures (in their case, Chinese and American cultures). Thus, our results should be interpreted with caution. Future research could investigate if the findings are transferable to other cultural settings and under which conditions.

Second, we focused on tensions between competitive economic and sustainability strategies (Hengst et al. 2020). Therefore, we deliberately omitted further tensions that might arise between ecological and social objectives. Hall and Vredenburg (2003) bring up the example of environmental solutions that are not socially accepted and thus not socially sustainable. An electric car is more environmentally sustainable but comes with a potential social disadvantage, as it is not available to everyone in the population due to its higher prices. Therefore, it would increase social inequality. In sustainability measurements for companies, community service and customer responsibility are part of the social performance pillar (Ioannou and Serafeim 2012). Thus, two topics would be of interest to future research. First, how innovation portfolios define and integrate social sustainability into their innovation processes. In addition, a qualitative study could shed light on dealing with tensions between ecological and social objectives and their effects on portfolio innovativeness.

Third, future studies could open the black box on how innovation portfolios manage contradictory tensions and if there are

mechanisms that mediate the relationship between sustainability tensions and innovation performance.

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Ethics Statement

The authors have read and agreed to the Committee on Publication Ethics (COPE) international standards for authors.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data supporting this study's findings are confidential and, therefore, cannot be made publicly available.

Endnotes

¹Strategic sustainability orientation is a three-item variable answered by decision-makers that incorporates the following items: Sustainability plays an important role in our strategy formulation/ we actively try to formulate a sustainable strategy for our company/ We regularly review which strategic aspects we can make sustainable in the company.

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Appendix A

Survey Items

Hypotheses Variables

Construct	Informant	Items	Lambda
Sustainability tensions	Decision-maker	We experience tensions in prioritization between sustainability values and the economic values of the competitive strategy.	0.61
(Alpha = 0.768; AVE = 0.542; CR = 0.777)		The economic and sustainable attributes of our project results are at odds with each other.	0.74
		We experience tensions between the strategic goals of the competitive strategy while simultaneously adhering to goals of the sustainability strategy.	0.85
Portfolio innovativeness (2nd order construct)			
Market innovativeness	Coordinator	Our products/project results ...	
(Alpha = 0.798; AVE = 0.550; CR = 0.785; 2nd order loading 0.88)		... offer new customer benefits which were not previously provided by any other products.	0.66
		... create a completely new market.	0.74
		... completely change the way our market functions.	0.81
Technological innovativeness	Coordinator	Our products/project results ...	
(Alpha = 0.872; AVE = 0.672; CR = 0.860; 2nd order loading = 0.69)		... are based on new technological principles.	0.74
		... use new technologies that make older technologies obsolete.	0.85
		... use technologies that enable leaps in performance.	86
Entrepreneurial orientation (2nd order construct)			
Innovativeness	Decision-maker	In general, the top managers of my business unit favor ...	
(Alpha = 0.769; AVE = 0.521; CR = 0.764; 2nd order loading = 0.76)		... a strong emphasis on the marketing of tried and true products or services. -- ... a strong emphasis on R&D, technological leadership, and innovations.	0.82
		How many new lines of products or services has your business unit marketed during the past 3 years?	0.68
		No new lines of products or services. -- Many new lines of products or services.	
		Changes in product or service lines have been mostly of a minor nature. -- Changes in product or service lines have usually been quite dramatic.	0.65
Risk-taking	Decision-maker	In general, the top managers of my business unit have ...	
(Alpha = 0.783; AVE = 0.517; CR = 0.762; 2nd order loading = 0.83)		... a strong proclivity for low risk projects (with predictable and moderate rates of return). -- ... a strong proclivity for high risk projects (with chances for very high returns).	0.75
		Due to the nature of the environment...	0.65
		... it is best to explore it gradually via cautious, incremental behavior. -- ... bold, wide-ranging acts are necessary to achieve the firm's objectives.	
		When confronted with decision-making situations involving uncertainty, my business unit ...	0.75
		... typically adopts a cautious "wait-and-see" posture in order to minimize the probability of making costly decisions. -- ... typically adopts a bold, aggressive posture in order to maximize the probability of exploiting potential opportunities.	
Proactiveness	Decision-maker	In dealing with its competitors, my business unit ...	
(Alpha = 0.698; AVE = 0.442; CR = 0.694; 2nd order loading = 0.86)		... typically responds to actions which competitors initiate. -- ... typically initiates actions to which competitors respond.	0.69

Construct	Informant	Items	Lambda
Innovation climate	Coordinator and project managers	... is seldom the first business to introduce new products/services, administrative techniques, operating technologies, and so forth -- ... is very often the first business to introduce new products/services, administrative techniques, operating technologies, and so forth.	0.80
		... typically seeks to avoid competitive clashes, preferring a “live-and-let-live” posture. -- ... typically adopts a very competitive “undo-the-competitors” posture.	0.46
		In our organization, ...	
		(Alpha = 0.873; AVE = 0.654; CR = 0.883) ... employees are given sufficient responsibility, resources, and freedom to work independently.	0.74
		... communication is open, meaning that we share information and appreciate debates and diverse opinions.	0.76
		... we emphasize creativity and innovativeness.	0.89
		... supervisors encourage unconventional ideas.	0.84

Note: Model fit $\chi^2[198] = 265.880$; comparative fit index [CFI] = 0.928; root mean square error of approximation [RMSEA] = 0.057; standardized root mean square residual [SRMR] = 0.075.

Abbreviations: AVE, average variance extracted; CR, composite reliability.

Control Variables

Construct	Informant	Items	Lambda
Technology turbulence	Decision-maker	The technology used in our industry is changing rapidly.	0.82
(Alpha = 0.806; AVE = 0.567; CR = 0.796)		There are frequent technological breakthroughs in our industry.	0.76
		Technological changes provide big opportunities in our industry.	0.67
Market turbulence	Decision-maker	In our industry customer preferences change relatively quickly.	0.75
(Alpha = 0.763; AVE = 0.529; CR = 0.769)		In our industry it is difficult to predict how customers' needs and requirements will evolve.	0.79
		In our industry it is difficult to forecast competitive actions.	0.63
Strategic control	Coordinator	We regularly review the feasibility of the portfolio strategy based on the information obtained in projects.	0.85
(Alpha = 0.922; AVE = 0.812; CR = 0.928)		We regularly review the premises of strategic portfolio planning based on new developments in the projects.	0.95
		Based on the information gained in projects, we deliberately question the portfolio strategy.	0.90
Formalization	Coordinator	Essential project decisions are made within clearly defined portfolio meetings.	0.78
(Alpha = 0.923; AVE = 0.768; CR = 0.930)		Our project portfolio management process is divided in clearly defined phases.	0.89
		Our process for project portfolio management is clearly specified.	0.94
		Overall, we execute our project portfolio management process in a well-structured manner.	0.89

Note: Model fit $\chi^2[59] = 125.38$; comparative fit index [CFI] = 0.927; root mean square error of approximation [RMSEA] = 0.104; standardized root mean square residual [SRMR] = 0.066.

Abbreviations: AVE, average variance extracted; CR, composite reliability.