CONNECTING SOCIOEMOTIONAL WEALTH TO GREEN PRODUCT INNOVATION: THE ROLE OF ABSORPTIVE CAPACITY

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ABSTRACT

Academic Summary

As one of the main drivers of sustainable development, green product innovation (GPI) has received increasing attention from academia. However, few works have investigated this issue in the family business context, none of them directly addressing the role of family owners' nonfinancial preferences on GPI. To extend our knowledge on this topic, this study builds on the socioemotional wealth (SEW) perspective to investigate how SEW affects GPI in family firms, while also considering the mediating role of absorptive capacity. Drawing on the FIBER conceptualization of SEW, we relate five SEW dimensions to potential/realized absorptive capacity and GPI. Our empirical analysis on a sample of 249 private family firms indicates that family firms' inclination toward GPI depends on the SEW dimensions that are valued by the owning family. Furthermore, potential and realized absorptive capacity mediates the relationship between four SEW dimensions (family control and influence, identification of family members, binding social ties and renewal of family bonds) and GPI. Overall, this study demonstrates the importance of considering the interrelation between family and organizational factors to understand green product innovation heterogeneity in the family business context.

Managerial Summary

This study explores how family owners' SEW preferences influence GPI through absorptive capacity. Our findings reveal that when family firms emphasize reputation, stakeholder trust, or continuity across generations, developing both potential and realized absorptive capacity is essential for driving GPI. To achieve this, we recommend that firms invest in cross-functional collaboration, form partnerships with universities or research institutions, and implement training programs that keep employees informed about emerging trends and technologies. These practices strengthen the firm's ability to identify, integrate, and apply external knowledge, translating it into effective green product innovation strategies. Additionally, we find that when family firms prioritize control, GPI practices must adapt to preserve family decision-making authority. Family-led innovation teams and collaboration with trusted external advisors can help firms absorb external knowledge while safeguarding family influence. Therefore, we advise family businesses to tailor their knowledge management and innovation strategies to their specific SEW priorities in order to foster GPI. For policymakers, these findings highlight concrete pathways to support family firms' role in green innovation, contributing to broader policy initiatives such as the European Union's research and innovation agenda.

Keywords: family firms, green product innovation, socioemotional wealth, absorptive capacity.

1 Introduction

As a result of the greater awareness of the dramatic consequences of climate change and the emergence of stricter environmental regulations, green product innovation (henceforth, GPI) — defined as the development of new products that consume fewer resources and have a reduced environmental impact (Chen & Liu, 2020)—has received increasing attention from companies and society all around the world (e.g., Bianchi & Testa, 2022; Haffar & Searcy, 2018; Juntunen et al., 2019; Zhao et al., 2023). This is particularly true in Belgium where the Energy Pact and the National Pact for Strategic Investments have given rise to a large variety of national and regional policies aimed at boosting firms' efforts in reducing their environmental footprint, with two third of Belgian firms incorporating green development as a central part of their innovation strategy (PWC, 2022). Recognized as the engine of sustainable development by improving the quality of life through wealth creation and competitiveness (Sheng & Ding, 2024; Fliaster & Kolloch, 2017), GPI has also garnered scholarly attention over the years, an increasing number of studies analyzing the organizational forces driving this form of green innovation (Khan et al., 2021).

Despite this growing interest, very limited research has delved into GPI in the family business context. This is a startling statement considering that family firms are the most dominant form of organizations worldwide (De Massis et al., 2018) and are therefore well-positioned to contribute meaningfully to sustainable development through green initiatives (Miroshnychenko & De Massis, 2022). Furthermore, existing literature suggests that family firms exhibit distinctive environmental behaviors (Miroshnychenko et al., 2021), particularly in the realm of green innovation (e.g., Dangelico, Nastasi, & Pisa, 2019; Huang, Ding, & Kao, 2009). Within this research stream, scholars emphasize the critical influence of family owners' behavioral motives on green innovation. Specifically, they suggest that the desire to preserve socioemotional wealth (SEW)—that is, the social, emotional, and affective endowments family

owners have invested in the firm (Gómez-Mejía et al., 2007)—significantly influences the adoption of environmentally focused innovations (Huang, Yang, & Wong, 2016).

Current research offers inconclusive evidence regarding the impact of SEW on green innovation. While some studies argue that SEW-related motivations, such as the desire to protect the family's image and reputation or to ensure the transmission of a sustainable business to future generations, enhance family owners' commitment to green innovation (Ardito et al., 2019; Berrone et al., 2010; Miroshnychenko & De Massis, 2022), others contend that SEW-induced characteristics, including risk aversion and a preference for tradition and the status quo, may hinder their willingness to pursue such innovation (Aiello et al., 2021; Huang et al., 2016). These divergent perspectives suggest that treating SEW as a unified construct may obscure the nuanced and potentially conflicting motivations that influence green innovation, highlighting the urgent need to disentangle the impact of family owners' SEW preferences on GPI. This is particularly crucial, as limited research has empirically captured SEW or accounted for the heterogeneity of family owners' SEW preferences in explaining the variability of green innovation across family firms (Li et al., 2023). To this end, we draw on the FIBER model (Berrone, Cruz, & Gómez-Mejía, 2012), which disentangles SEW into five distinct dimensions—family control and influence, identification of family members, binding social ties, emotional attachment, and renewal of family bonds through dynastic succession—to examine how each of these preferences impacts family owners' attitudes toward GPI.

While disentangling the influence of these SEW dimensions on GPI is an important step forward, understanding their impact on green innovation outcomes requires a deeper exploration of the mechanisms through which SEW preferences shape innovation behavior. One such mechanism, well established in the knowledge management literature, is absorptive capacity (AC) (Aboelmaged & Hashem, 2019; Zhang et al., 2020). AC encompasses two interrelated dimensions: potential absorptive capacity (PAC), which reflects a firm's ability to

acquire and assimilate external knowledge, and realized absorptive capacity (RAC), which pertains to its ability to transform and exploit that knowledge (Cohen & Levinthal, 1990; Todorova & Durisin, 2007; Miroshnychenko et al., 2021). These capabilities have proven crucial for facilitating the integration of key external knowledge in the development of new technologies and sustainable products (Gluch, Gustafsson, & Thuvander, 2009; Flor, Cooper, & Oltra, 2018). In family firms, however, building PAC and RAC can be particularly complex, as SEW reference points may shape each dimension in distinct—and at times opposing—ways. For instance, Kotlar et al. (2020) suggest that strong emotional attachment among family owners may lead to entrenchment in existing knowledge bases, resistance to external ideas, and organizational rigidities that hinder knowledge acquisition and adaptation (PAC). Conversely, this same emotional attachment may motivate family owners to transform and exploit acquired knowledge (RAC), as family owners may be more motivated to transform and exploit knowledge in ways that uphold the family's legacy and reputation. Therefore, AC, through its dual dimensions, may serve as a key mediating mechanism through which the heterogeneous SEW preferences of family owners influence GPI. Given the ongoing theoretical and empirical debate on these dynamics (Pütz & Werner, 2024), this study seeks to explore how PAC and RAC, as distinct yet complementary pathways, mediate the relationship between the FIBER dimensions of SEW and GPI.

Our study, based on an original dataset of 249 Belgian private family firms, makes several important contributions. First, this study addresses the mixed evidence surrounding family firms' innovation behaviors (Calabrò et al., 2019) by responding to calls for more targeted investigations into how their unique characteristics shape specific forms of innovation (Hu & Hughes, 2020). It specifically explores the role of SEW in driving green innovation, a topic that has sparked debate in the still-limited body of research (Miroshnychenko et al., 2022). By adopting a multidimensional perspective through the FIBER framework, the study moves

beyond the common unidimensional treatment of SEW (Bammens & Hünermund, 2020; Huang et al., 2016), offering a more refined understanding of how diverse SEW priorities influence variations in GPI across family firms. This approach deepens our understanding of how family-specific factors drive differences in GPI among family firms, underscoring the importance of moving beyond a homogeneous view of family firms and embracing a more differentiated perspective when analyzing their green innovation behaviors. Second, by demonstrating that PAC and RAC serve as key mediators in the relationship between the FIBER dimensions and GPI, we advance prior research that has thus far overlooked the knowledge-based mechanisms through which SEW influences innovation. Our findings show that the FIBER dimensions exert ambivalent effects on PAC and RAC and confirm both as critical drivers of GPI in family firms. In this way, we advance understanding of the antecedents and outcomes of AC in the family business context (Kotlar et al., 2020) and address recent calls to disentangle how family owners' behavioral motives shape AC and its impact on innovation (Pütz & Werner, 2024). Third, through the application of the SEW perspective, we offer novel insights into how its multifaceted dimensions influence GPI decisions. Specifically, our study provides a more granular understanding of how different aspects of SEW can lead to divergent innovation outcomes. In so doing, we account for the multifaceted nature of SEW to develop a more fine-grained understanding of how family owners' heterogeneous SEW reference points explain GPI, while also offering further validation of the FIBER model as a compelling tool to capture the multidimensionality of the SEW construct (Gómez-Mejía & Herrero, 2022).

2 Theoretical Background

2.1 Green Product Innovation in Family Firms

Amid growing awareness of environmental sustainability among firms and communities (Xue et al., 2022), scholarly interest in green innovation has surged in recent years (Sheng & Ding, 2024; Karimi Takalo, Sayyadi Tooranloo, & Shahabaldini Parizi, 2021). Yet, despite this

momentum, research on green innovation within the family business context remains nascent (Ardito et al., 2019; Doluca, Wagner, & Block, 2018), a notable gap given that family firms are often found to be more environmentally conscious than their nonfamily counterparts (e.g., Berrone et al., 2010; Delmas & Gergaud, 2014; Mariani, Al-Sultan, & De Massis, 2021). In this emerging literature, Huang et al. (2009) show that internal stakeholder pressures more strongly influence the adoption of green practices in family firms, while external pressures have a comparatively weaker effect. In contrast, Aiello et al. (2021) find that family firms are generally less likely to engage in green patenting, regardless of their existing knowledge base. Dangelico et al. (2019) further highlight how inherent characteristics of family firms, such as organizational culture, flexibility, long-term orientation, noneconomic goals, and generational stage, can shape their engagement with green innovation.

Despite this growing body of work, family business scholars have largely overlooked GPI, defined as "*product innovation that is related to environmental innovation, including the innovation in products that are involved in energy-saving, pollution-prevention, waste recycling, no toxicity, or green product designs*" (Chen, Lai, & Wen, 2006: 334). This gap is surprising, given that GPI may represent a particularly attractive strategic avenue for family firms—offering both financial and nonfinancial benefits (Dangelico, 2017). Indeed, prior research suggests that GPI can enhance market share (Leonidou, Katsikeas, & Morgan, 2013), improve profitability (Xie, Huo, & Zou, 2019), reduce environmental impact (Awan, Arnold, & Gölgeci, 2021), and strengthen a firm's image and reputation among stakeholders (Dangelico & Pujari, 2010; Gangi, Daniele, & Varrone, 2020). However, GPI also entails notable nonfinancial costs, such as a potential loss of family control due to the need for external expertise and capital (Zhang et al., 2021), as well as emotional tensions stemming from disruptions to established innovation routines (Huang & Li, 2017). These factors can shape

family owners' willingness to invest in GPI, depending on their priorities and risk perceptions (Huang et al., 2016).

Taken together, these insights underscore the complexity of GPI decision-making in family firms and highlight the need to account for family owners' nonfinancial preferences in understanding its antecedents. This study addresses this gap by drawing on the SEW framework to explore how the pursuit of diverse nonfinancial goals may help explain family firm heterogeneity in GPI engagement.

2.2 A Socioemotional Wealth Approach to Green Product Innovation and Absorptive Capacity

Over the past fifteen years, the SEW perspective has emerged as a dominant paradigm in family business research (Gómez-Mejía & Herrero, 2022). Rooted in prospect theory and behavioral agency theory (Wiseman & Gómez-Mejía, 1998), the foundational work of Gómez-Mejía et al. (2007) introduced SEW as the nonfinancial utility that family owners derive from their involvement in the business (Gast et al., 2018). SEW serves as a central reference point for decision-making in family firms, often leading to strategic orientations that diverge from those of nonfamily firms. This is particularly evident in privately held family firms, where owners typically exert greater influence over governance and are less constrained by external market forces (Carney et al., 2015). Within this framework, family owners are often willing to pursue strategies that pose greater risks to their financial wealth if such actions help preserve or enhance their SEW (Gómez-Mejía, Cruz, & Imperatore, 2014; Gómez-Mejía et al., 2007). Although the SEW perspective has significantly advanced our understanding of strategic decision-making in family firms, including innovation (Bauweraerts et al., 2022) and environmental strategies (Berrone et al., 2010), most empirical studies rely on indirect proxies, such as family ownership or management, to capture SEW, often overlooking its multidimensional nature (Swab et al., 2020).

Addressing recent calls to better theorize and empirically capture this multidimensionality (Blanco-Mazagatos et al., 2024), we explore whether different SEW reference points lead to heterogeneous decisions regarding GPI. This focus is important as family owners often hold distinct SEW priorities that shape their evaluation of strategic options (Gómez-Mejía et al., 2014). Indeed, scholars have observed that decision-making in family firms depends on which SEW dimension family owners use as a primary reference point (Aberg et al., 2024), arguing that examining the influence of individual SEW dimensions may help explain the diverse ways in which family firms make strategic choices (Berrone et al., 2012). Moreover, although SEW dimensions are often interrelated, prior research shows they may exert divergent—or even conflicting—effects on strategic behavior (Filser et al., 2018; Swab et al., 2020), highlighting the need for a more nuanced, dimension-specific perspective on SEW in decision-making (Bauweraerts et al., 2022). Building on these insights, we adopt the FIBER framework developed by Berrone et al. (2012), which conceptualizes SEW across five dimensions: family control and influence (F), identification of family members with the firm (I), binding social ties (B), emotional attachment (E), and renewal of family bonds through dynastic succession (R). We propose that family owners' commitment to preserving each dimension of the FIBER framework influences their propensity to engage in GPI.

While the FIBER dimensions may exert distinct direct effects on GPI, a more nuanced understanding requires uncovering the underlying mechanisms that mediate this relationship. We argue that AC represents a critical, yet underexplored, knowledge-based mechanism through which SEW preferences shape GPI outcomes. AC comprises four interrelated dimensions: knowledge acquisition, assimilation, transformation, and exploitation (Cohen & Levinthal, 1990; Zahra & George, 2002). The first two dimensions—acquisition and assimilation—constitute PAC, while the latter two—transformation and exploitation—represent RAC (Arzubiaga, Maseda, & Iturralde, 2019). Conceptually rooted in the knowledge-

based view of the firm, PAC and RAC reflect distinct but complementary capabilities for leveraging external knowledge (Zahra & George, 2002). PAC enables firms to identify and make sense of new knowledge, while RAC allows firms to transform and exploit that knowledge to generate innovation outcomes (Miroshnychenko et al., 2021). These capabilities are particularly vital in the context of GPI, as they enable firms to respond to environmental challenges through informed product development (Gluch et al., 2009; Kortman, 2015). Specifically, PAC allows firms to access and interpret external knowledge related to environmental regulations, pollution, and sustainability practices. RAC, in turn, facilitates the integration of this knowledge with existing capabilities to create environmentally oriented products (Aboelmaged & Hashem, 2019). Empirical evidence supports the role of both dimensions in enhancing a firm's ability to engage with stakeholders, identify environmental opportunities, and translate knowledge into GPI (Albort-Morant et al., 2018; Zhang et al., 2020).

In family firms, where owners often prioritize internal family knowledge in the knowledge management process (Arzubiaga et al., 2022), PAC and RAC become especially critical for overcoming these limitations and keeping pace with green innovation demands (Huang et al., 2016). However, these capabilities are not developed uniformly; rather, they are shaped by the distinctive features that characterize family firms (Garcés-Galdeano et al., 2024). For instance, PAC may be closely linked to the degree to which family firms are open to external collaboration and receptive to incorporating outside knowledge, whereas RAC is often shaped by internal dynamics such as trust, cohesion, and the family's willingness to adapt established routines (Garcés-Galdeano et al., 2024; Pütz & Werner, 2024). Delving into the family firm-specific antecedents of AC, Kotlar et al. (2020) acknowledge the importance of family owners' behavioral motives in explaining variation in both PAC and RAC. Especially, they suggest that family owners' preferences for power concentration or emotional attachment can lead to

diverging effects on both dimensions of AC. Extending this logic, Pütz and Werner (2024) call for a more nuanced understanding of how different SEW dimensions influence AC, as each may uniquely affect PAC and RAC, ultimately leading to varying GPI outcomes across family firms

Building on these arguments, we argue that the FIBER dimensions of SEW indirectly affect GPI through their influence on PAC and RAC. A summary of our mediation model is presented in Figure 1.

[Insert Figure 1]

3 Hypothesis Development

3.1 FIBER Dimensions and GPI

The "family control and influence" dimension reflects the authority that family members wield to shape key strategic decisions, both through formal governance roles and informal influence mechanisms (Berrone et al., 2012). When this dimension becomes a dominant reference point, family owners prioritize preserving control over strategic and operational processes (Gast et al., 2018), even at the expense of pursuing innovation-driven opportunities. In this light, GPI may be perceived as a threat to the family's SEW, as it typically demands substantial organizational change, openness to external knowledge, and a willingness to share decision-making authority. Specifically, GPI requires resource-intensive commitments, including investments in R&D and access to specialized environmental expertise (Zhang et al., 2021). Meeting these requirements often necessitates hiring nonfamily professionals or partnering with external stakeholders—moves that can dilute family influence and challenge their desire for internal control (Vandekerkhof et al., 2015). Furthermore, securing external funding to support GPI initiatives may bring outside investors into the governance structure, potentially undermining the family's strategic autonomy (Neckebrouck, Meuleman, & Manigart, 2021). These implications can be

perceived as a direct threat to the family's control and influence, increasing the perceived risk of SEW losses. As a result, family owners who place a high value on control may be more reluctant to engage in GPI. Based on this reasoning, we propose:

Hypothesis 1a: There is a negative relationship between family control and influence and GPI.

When family members strongly identify with the firm, the boundaries between the family and the business become increasingly blurred (Berrone et al., 2012). In such cases, the firm's identity is perceived as an extension of the family's own (Campopiano & Rondi, 2019), leading both internal and external stakeholders to view the business as a reflection of the family itself. Internally, this perception influences attitudes not only toward employees but also toward the nature and quality of the products offered (Berrone et al., 2012). Externally, the family becomes more sensitive to how the firm is perceived by customers, suppliers, and other stakeholders (Bendell, 2022). As a result, family owners may become particularly responsive to environmental concerns voiced by both internal and external stakeholders, integrating these considerations into product development to uphold the firm's image. In this context, developing greener products with reduced ecological impact can function as a strategic tool to safeguard SEW, signaling both environmental responsibility and a strong commitment to sustainability. Accordingly, we argue that family owners who place strong emphasis on maintaining family members' identification with the firm are more likely to promote GPI, leading us to propose the following hypothesis:

Hypothesis 1b: There is a positive relationship between identification of family members and GPI.

The "binding social ties" dimension reflects the quality and depth of interactions between the family firm and its internal and external stakeholders (Hauck et al., 2016). When family firms actively nurture these connections, they build strong social capital rooted in enduring

relationships with employees, customers, suppliers, partners, and the broader community (Cennamo et al., 2012). This emphasis on social capital creates a climate of trust that facilitates the exchange of information and knowledge among family and nonfamily stakeholders (Sanchez-Famoso et al., 2019). As a result, family owners may view GPI as a means to further enhance social ties, as such innovation often relies on close collaboration with suppliers, partners, and customers to access specialized green knowledge, such as green technical know-how, sustainable product design, and insights into eco-conscious customer preferences (Song et al., 2020; Watson et al., 2018). Furthermore, by fostering strong social bonds, family owners become deeply committed to the well-being of stakeholders and individuals around them (Berrone et al., 2012). This sense of responsibility may motivate them to respond to growing societal demands for environmental protection by integrating sustainability into product development (Mariani et al., 2021). Therefore, we argue that family owners who use the "binding social ties" dimension of SEW as a primary reference point in their decision-making are more likely to engage in GPI, leading to the following hypothesis:

Hypothesis 1c: There is a positive relationship between binding social ties and GPI.

The "emotional attachment of family members" dimension highlights the powerful role emotions play within family firms (Swab et al., 2020). The firm often serves as a key source of emotional fulfillment, providing a sense of belonging, cohesion, and affective security for family owners (Bauweraerts et al., 2023). As a result, emotional dynamics frequently spill over between the family and business spheres, creating a unique interplay that shapes decision-making in distinctive and often deeply personal ways (Berrone et al., 2012; Cailluet, Bernhard, & Labaki, 2018). In such contexts, emotional attachment can foster risk aversion, as family owners may resist changes that threaten the family's emotional harmony or disrupt long-standing traditions (Labaki, Michael-Tsabari, & Zachary, 2013). As GPI often requires reconfiguring existing capabilities and altering routines to embed environmental goals into

product development (Mousavi, Bossink, & van Vliet, 2018), emotionally attached family owners may perceive such shifts as a threat to their SEW (Huang & Li, 2017). Thus, emotional attachment may act as a barrier to GPI, especially when innovation challenges deeply rooted family values and practices. As a result, family owners who prioritize emotional attachment in their decision-making may be disincentivized from pursuing GPI. Therefore, we posit the following hypothesis:

Hypothesis 1d: There is a negative relationship between emotional attachment of family members and GPI.

Unlike the "family control and influence" dimension, which emphasizes the provision of permanent job security for all current family members, the "renewal of family bonds" dimension focuses on the long-term well-being of motivated future generations, reflecting family owners' commitment to sustaining the family legacy through dynastic succession (Berrone et al., 2012). Guided by this aspiration, family owners often adopt a long-term orientation, prioritizing sustainable decisions that ensure the continuity and resilience of the business across generations (Hammond, Pearson, & Holt, 2016). This long-term orientation extends their investment horizon and positions them as providers of patient capital—that is capital committed for the long haul and not driven by short-term returns (Miller & Le Breton-Miller, 2021). Within this transgenerational frame, GPI is likely to be viewed as a strategic investment aligned with long-term prosperity and environmental stewardship. Investing patient capital in GPI enables family firms to pursue product differentiation and develop sustainable competitive advantages by creating environmentally conscious products (Melander, 2017). Moreover, the desire to pass on a thriving and responsible business to future generations strengthens intergenerational ties and encourages family owners to consider the broader, long-term environmental impact of their innovation choices (Delmas & Gergaud, 2014). As a result, family owners who prioritize the renewal of family bonds are more likely to support product

development with a reduced environmental footprint, seeking to ensure that future generations inherit a business aligned with sustainability values. Based on this reasoning, we propose the following hypothesis:

Hypothesis 1e: There is a positive relationship between renewal of family bonds and GPI.

3.2 The Mediating Role of Absorptive Capacity

When family control and influence serve as the primary reference point for decision-making, they shape the firm's knowledge processes in distinct ways, thereby influencing GPI through their differential impact on PAC and RAC. The concentration of power within family-owned firms can facilitate PAC, as family owners encounter fewer internal constraints and wield greater bargaining power (Vandekerkhof et al., 2015), enabling more efficient knowledge acquisition. This authority streamlines decision-making by reducing bureaucratic delays and procedural hurdles, broadening the firm's capacity to assimilate external knowledge (Zahra & George, 2002). Moreover, it permits flexible and informal decision-making that bypasses rigid managerial structures, further enhancing PAC (Todorova & Durisin, 2007). As such, PAC may serve as a reinforcing mechanism through which family control supports GPI, particularly because it allows family owners to maintain their decision-making dominance while selectively incorporating environmentally relevant knowledge (Kotlar et al., 2020). In contrast, the same concentration of control may impede RAC, which relies on the broader organization's ability to transform and exploit acquired knowledge. RAC is heavily dependent on the engagement of nonfamily employees and middle managers, whose contributions are critical to embedding knowledge into routines and achieving innovation outcomes (Bunderson & Reagans, 2011). When authority is concentrated in the hands of family members, these nonfamily actors may be excluded from key decision-making processes, reducing knowledge sharing, weakening collective learning, and diminishing motivation (Kotlar et al., 2020). As a result, RAC may

represent a negative pathway through which family control undermines GPI, especially when inclusive and participatory practices are lacking (Arzubiaga et al., 2022).

Family-firm identification also plays a pivotal role in enhancing both PAC and RAC, which in turn serve as critical mechanisms through which family firms support GPI. For family owners who deeply associate their personal identity with the business, safeguarding the firm's reputation and projecting a favorable image to stakeholders is a central concern (Berrone et al., 2012). As Kotlar et al. (2020, p. 11) observe, "the family owners' personal feelings, name, and reputation are at stake," which intensifies their motivation to ensure innovation success as a means of reinforcing the firm's legitimacy and standing. GPI, in particular, requires the ability to acquire and exploit diverse, rapidly evolving, and often highly specialized external knowledge (Ardito et al., 2019). This is because GPI demands that firms navigate complex technological, regulatory, and market dynamics—such as implementing cleaner production processes, complying with stricter environmental regulations, and responding to shifting stakeholder expectations—all of which hinge on timely access to, and effective use of, external expertise (Aboelmaged & Hashem, 2019). In this context, PAC and RAC become not only technical enablers but also strategic instruments through which family owners demonstrate their commitment to green innovation and SEW preservation. Accordingly, family owners with strong firm identification are more likely to actively leverage these capabilities in support of GPI.

The role of binding social ties is equally clear. This core SEW dimension reflects the trust-based relationships family firms develop with internal and external stakeholders—assets that can significantly enhance GPI through both dimensions of AC. Since PAC involves acquiring and assimilating external knowledge, strong external relationships can facilitate access to cutting-edge green technologies, market intelligence, and regulatory insights (Ardito et al., 2019). Trusted ties with suppliers or industry partners, for instance, may lead to early exposure

to sustainable materials or collaborative green innovation opportunities. Similarly, RAC, which entails transforming and exploiting newly acquired knowledge internally, is strengthened by cohesive, trust-based internal networks that foster open communication, shared values, and cross-functional collaboration among family and nonfamily collaborators (Arzubiaga et al., 2022)—conditions that are critical for implementing complex green innovations (Jansen, Van Den Bosch, & Volberda, 2005). By fostering PAC and RAC, binding social ties serve as relational assets that not only facilitate green innovation but also help preserve strong stakeholder connections. Family owners who prioritize this SEW dimension are therefore inclined to view PAC and RAC as both strategic enablers of GPI and as mechanisms aligned with their relational goals and SEW priorities.

Emotional attachment, however, can exert divergent effects on PAC and RAC, thereby shaping GPI through distinct pathways. Family owners who highly value this dimension often prioritize preserving the firm's traditions, values, and emotional bonds, leading to a strong attachment to the existing knowledge base (Chirico & Salvato, 2016). As a result, they may resist acquiring new external knowledge (Nieto, Santamaria, & Fernandez, 2015), fearing it could disrupt established knowledge structures or require divesting assets linked to past success (Feranita, Kotlar, & De Massis, 2017; Sharma & Manikutty, 2005). In this light, PAC may be perceived as a threat to SEW, making these owners less inclined to adopt it in pursuit of GPI. Conversely, RAC—focused on integrating already acquired knowledge—aligns more closely with emotional attachment. Given that family owners often invest a substantial portion of their personal wealth in the firm, they are strongly incentivized to ensure that acquired external knowledge is used both efficiently and intensively (Kotlar et al., 2020). This financial investment is often accompanied by emotional and psychological attachment, developed through the time and effort spent during the acquisition and assimilation process (Arzubiaga et al., 2022). Such attachment reinforces their commitment to seeing this knowledge effectively

integrated into the firm's green innovation effort. Accordingly, family owners who place strong emphasis on emotional attachment are more likely to rely on RAC as a means to enhance GPI.

When family owners draw on the renewal of family bonds through dynastic succession as their primary reference point, they demonstrate a strong commitment to the transgenerational continuity of the business. This orientation cultivates a collective sense of responsibility toward long-term sustainability, thereby increasing the likelihood of allocating multi-year investments to strategic horizon-scanning initiatives aimed at identifying green innovation opportunities. Under such conditions, the ability to acquire and assimilate external knowledge becomes essential for developing the capabilities required to transform these opportunities into innovative green products. Accordingly, PAC emerges as a critical knowledge-based mechanism through which family firms support GPI, enabling them to counteract organizational inertia and advance their transgenerational objectives (Pattinson & Preece, 2014). Furthermore, the pursuit of intergenerational continuity often prompts family owners to foster collaboration between incumbent and successor generations (Filser et al., 2018). These collaborative dynamics facilitate the systematic transformation and institutionalization of externally sourced green knowledge into the firm's routines and practices (Aiello et al., 2021; Jaskiewicz, Combs, & Rau, 2015). Such a long-term, future-oriented perspective mitigates the risk of disregarding new knowledge and instead promotes its integration with existing expertise, thereby enhancing the firm's capacity to effectively exploit knowledge and generate tangible green innovation outcomes (Ardito et al., 2019). Family owners who strongly value the renewal of family bonds may thus see both PAC and RAC as critical to supporting GPI.

While family owners' preferences for specific FIBER dimensions help explain the variability in family firms' commitment to GPI, our arguments refine this view by suggesting that these dimensions can either facilitate or hinder the knowledge-based mechanisms that drive GPI. Depending on which SEW dimension serves as the focal point for decision making, PAC and

RAC may be perceived as either supporting or threatening to SEW, ultimately influencing the extent to which they are used to promote GPI. We therefore propose the following hypotheses:

Hypothesis 2: PAC mediates the relationship between (a) family control and influence, (b) identification of family members, (c) binding social ties, (d) emotional attachment of family members, (e) renewal of family bonds and GPI.

Hypothesis 3: RAC mediates the relationship between (a) family control and influence, (b) identification of family members, (c) binding social ties, (d) emotional attachment of family members, (e) renewal of family bonds and GPI.

4 Methodology

4.1 Sample

The data for this study were collected from a 2018 survey exploring ownership structures, managerial characteristics, and eco-innovation strategies among Belgian private family firms. Belgium is an ideal context for this research, with over 65% of private firms being family-owned (Lambrecht & Brockaert, 2018). Additionally, Belgium's eco-innovation performance is close to the EU average, supported by strategic frameworks like the Smart Specialization Strategy and the Federal Institute for Sustainable Development (European Commission, 2019).

To determine the survey population, we used the Belfirst–Bureau Van Dijk database, which contains accounting, social, and financial data for approximately 500,000 Belgian companies. We selected private, non-listed companies with at least 10 employees to exclude micro-firms lacking the capabilities for green innovation (Hoogendoorn, Guerra, & van der Zwan, 2015). Firms belonging to groups were excluded to avoid those with disproportionate access to technological and financial resources (Ray & Chaudhuri, 2018). The survey population was further restricted to the primary and secondary sectors, as firms in the tertiary and quaternary

sectors are less likely to engage in green product innovation (Stucki et al., 2018), resulting in a final population of 108,547 private firms.

From this population, we randomly selected 3,000 firms and addressed the questionnaire to their CEO, as they play a key role in strategic decisions (Davis et al., 2010). To minimize common method bias, we implemented several procedural controls (Kock, Berbekova, & Assaf, 2021). The questionnaire, originally developed in English, was translated into French, Dutch, and German, then back-translated into English by independent translators to ensure accuracy. Pilot testing across diverse linguistic regions resulted in the development of a concise and nonredundant questionnaire. The cover letter emphasized confidentiality and offered a summary report to encourage participation.

After two waves of data collection, we received 308 responses (10.27% response rate), which is consistent with similar studies on private firms (e.g., Arzubiaga et al., 2018; Kammerlander et al., 2015). To identify family firms, we used a widely accepted definition: more than 50% ownership by a single family, with the CEO self-identifying the company as a family business (Hernández-Linares et al., 2019). After excluding 43 nonfamily firms and 16 incomplete questionnaires, 249 family firms remained. To check for nonresponse bias, we compared early and late respondents using Chi-square and t-test analyses, finding no significant differences. Additionally, a Kolmogorov–Smirnov test revealed no significant demographic differences between responding and nonresponding firms. These analyses suggest minimal nonresponse bias in our study.

4.2 Measures

This research primarily employs validated scales derived from existing works. All scale items (listed in Table 1) are measured using a five-point Likert-type scale, ranging from 1 to 5, where higher scores indicate higher levels of the respective construct.

Green product innovation (GPI). GPI is measured using a four-item scale adapted from previous studies (e.g., Chen et al., 2006; Singh et al., 2020). The items assess the firm's use of recyclable materials, energy-efficient processes, and nonpolluting methods in the production and design of environmentally friendly products.

SEW dimensions. SEW dimensions are measured using the five-dimensional FIBER scale developed by Berrone et al. (2012). The use of this scale to capture SEW dimensions has been conceptually validated (e.g., Arzubiaga et al., 2021; Cennamo et al., 2012; Le Breton-Miller & Miller, 2013) and found empirically reliable in several studies (e.g., Dayan, Ng, & Ndubisi, 2019; Filser et al., 2018; Ng, Dayan, & Di Benedetto, 2019).

Absorptive capacity. To operationalize AC, we build on previous studies that distinguish between PAC and RAC (Flatten et al., 2011; Flor et al., 2018; Jansen et al., 2005). This distinction is particularly relevant in our empirical setting, as research has adopted this categorization to examine differences in AC between family and nonfamily firms (Andersén, 2015). Moreover, prior research highlights that family-specific factors can lead to divergent outcomes across the dimensions of PAC and RAC (Kotlar et al., 2020; Pütz & Werner, 2024), further reinforcing the value of incorporating this distinction within our sample of family firms. Consistent with Miroshnychenko et al. (2021), this study treats both PAC and RAC as second-order formative constructs. PAC is measured through its facets of "acquisition" and "assimilation," while RAC is assessed through the dimensions of "transformation" and "exploitation." Specifically, PAC is captured using seven items that assess the intensity, speed, and direction of efforts devoted to acquiring relevant new knowledge (knowledge acquisition) and the firm's ability to identify, analyze, and understand the acquired knowledge (knowledge assimilation). RAC is measured with seven items focusing on efforts to integrate both existing and newly acquired external knowledge (knowledge transformation) and apply this knowledge to operational practices to achieve business objectives (knowledge exploitation).

Control variables. Given their potential impact on GPI, we incorporated several control variables into our model. To account for the firm's lifecycle, we controlled for *Firm age* and *Firm size*. *Firm age* is the natural logarithm of the number of years the firm has been in operation (Bauweraerts et al., 2022), while *Firm size* is the natural logarithm of the number of full-time employees (Huang et al., 2016). Since the presence of a family member as CEO influences green behaviors (Berrone et al., 2010), we included a dummy variable, *Family CEO*, which takes the value of 1 when a family member is CEO, and 0 otherwise. To account for generational differences in family firms, we controlled for Generation in control (*GC*) and Generational involvement (*Gen Inv*). Following prior studies (Pittino et al., 2018), *GC* is a continuous variable determined by asking which generation is responsible for managing the company, while *Gen Inv* represents the number of generations involved in the top management team (Sanchez-Famoso et al., 2019). Finally, we controlled for sector effects by distinguishing between the primary sector (agriculture and food) and the secondary sector (industry), with the primary sector serving as the reference category.

5. Results

To test our hypotheses, we used structural equation modeling (SEM) to explore the interdependencies between observed and latent variables (Kline, 1998). We employed partial least squares structural equation modeling (PLS-SEM) for several reasons. First, previous research suggests that, compared to covariance-based SEM techniques (e.g., AMOS), PLS-SEM is better suited for analyzing individual constructs and complex cause–effect relationships, making it ideal for examining the influence of SEW dimensions on GPI and the mediating role of PAC and RAC (Sarstedt, Ringle, & Hair, 2014). Second, PLS-SEM handles nonnormally distributed data, mitigating skewness and ensuring robustness in results (Hair et al., 2012). Third, PLS-SEM is effective for optimally weighing and combining items from lower-order constructs, ensuring the reliability of second-order latent constructs (Real, Roldán,

& Leal, 2014). Following Sarstedt et al. (2014), we assessed the research model in two steps: first, examining the measurement model, then testing the significance of the structural relationships.

5.1 Measurement Model

Our model incorporates both reflective and formative measurement specifications. The FIBER dimensions (Dayan et al., 2019) and GPI (Singh et al., 2020) are modeled as first-order reflective constructs, while PAC and RAC are second-order formative constructs that include knowledge acquisition, assimilation, exploitation, and transformation as their first-order reflective components (Miroshnychenko et al., 2021). We begin by assessing the reliability and validity of the first-order constructs before evaluating the second-order formative constructs.

In light of the ongoing debate surrounding the unidimensionality of the FIBER dimensions, we performed an exploratory factor analysis[1] (EFA) using principal component analysis with oblique (promax) rotation (k = 4) (Hauck et al., 2016). The EFA resulted in a five-factor model, explaining 67.412% of the total variance. We retained factors with eigenvalues greater than 1 and considered items with factor loadings above 0.700 as indicative of their respective factors (Hair et al., 2019). In addition to determining the number of factors extracted, we computed Revelle's beta for each FIBER dimension and compared these values with Cronbach's alpha to assess the unidimensionality of each dimension, as recommended by Cooksey and Soutar (2006). According to their guidelines, a difference greater than 0.150 between these two coefficients suggests nonunidimensionality. The Revelle's beta coefficients ranged from 0.714 to 0.776, indicating that the unidimensionality condition was met for each FIBER dimension.

Subsequently, we conducted a confirmatory factor analysis to assess the measurement model for all first-order reflective constructs based on individual item reliability, construct reliability, convergent validity, and discriminant validity (Henseler, Hubona, Ray, 2016). All factor

loadings exceed the 0.700 threshold (Nunnally, 1978), except for one item from the knowledge acquisition construct, which was excluded. As shown in Table 1, construct reliability is confirmed, with composite reliability (CR) surpassing the 0.700 threshold (Nunnally, 1978). Convergent validity is supported, as the average variance extracted (AVE) values exceed the recommended 0.500 threshold (Fornell & Larcker, 1981). Discriminant validity is established by demonstrating that the square root of AVE for each construct is greater than its inter-construct correlations (Fornell & Larcker, 1981). Furthermore, the heterotrait-monotrait (HTMT) ratios in Table 3 remain below 0.850, in line with Henseler et al. (2015), further reinforcing discriminant validity.

(Insert Tables 2 and 3 here)

To assess the validity of the second-order formative construct, we used the repeated indicator approach (Becker, Klein, & Wetzels, 2012), where first-order construct indicators serve as indicators for the second-order constructs. The paths between first-order constructs (knowledge acquisition, knowledge assimilation, knowledge exploitation, and knowledge transformation) and second-order constructs (PAC/RAC) reflect the formative constructs' weights (Sarstedt et al., 2019). As shown in Table 4, all first-order components of PAC and RAC have significant and positive weights. We also checked for collinearity issues by calculating variance inflation factors (VIFs), all of which were below the recommended threshold of 3 (Hair et al., 2019). Lastly, the latent variable correlations between the second-order constructs and other model variables, as reported in Table 5, did not exceed the 0.650 threshold (Brown, 2014). These results confirm the validity and reliability of the second-order constructs.

(Insert Tables 4 and 5 here)

To detect potential common method bias, we conducted a Harman’s single-factor test by loading all measurement items into an exploratory factor analysis. The test yielded a nine-factor

solution accounting for 61.243% of the total variance, with the first factor explaining only 14.562%. Additionally, we included a common method factor and compared the item loadings on the respective constructs to those on the common method factor (Liang et al., 2007). On average, items loaded 76.478% on the latent variables, while the method factor accounted for just 0.610%, yielding a substantive-to-method variance ratio of 125.368. The common method factor loadings were low and not significant (-0.162 to 0.183), whereas the item loadings were high and significant (0.721 to 0.924). These results suggest that common method bias is minimized.

5.2 Structural Model

The results of our structural model are presented in Table 6 and Figures 2 to 4. We used bootstrapping with 5,000 runs to test significance (Hair et al., 2012). For each model, we computed path estimates, T-statistics, VIFs, and f^2 effect sizes, which measure the variable contribution to the R^2 of an endogenous construct (Hair et al., 2012). VIF values ranged from 1.025 to 1.988, well below the threshold of 3 (Hair et al., 2019), indicating no serious multicollinearity issues. We also used blindfolding to assess predictive relevance with the cross-validated redundancy index (Q^2) for endogenous variables. As shown in Table 6, all endogenous constructs have satisfactory predictive relevance with Q^2 values greater than zero (Chin, 2010).

Model 1 examines the direct effects of control variables and SEW dimensions on GPI, explaining 32% of its variance ($R^2 = 0.326$). FCI ($\beta = -0.321$, $p < 0.050$) negatively affects GPI, while IFM ($\beta = 0.284$, $p < 0.050$), BST ($\beta = 0.348$, $p < 0.050$), and RFB ($\beta = 0.264$, $p < 0.050$) have positive effects. EAFM shows no significant impact on GPI. These results validate hypotheses 1a, 1b, 1c, and 1e. Notably, Family CEO ($\beta = 0.194$, $p < 0.050$), Gen Inv ($\beta = 0.489$, $p < 0.010$), and the secondary sector ($\beta = 0.184$, $p < 0.050$) positively affect GPI, while firm size ($\beta = -0.201$, $p < 0.050$) has a negative effect. f^2 values indicate that RFB ($f^2 = 0.060$) and

Gen Inv ($f^2 = 0.081$) explain most of the variance. A graphical summary is presented in Figure 2.

Models 2 and 3 incorporate our mediating variables (PAC and RAC), increasing the explained variance of GPI to 37.1% ($R^2 = 0.371$) with PAC and 36.2% ($R^2 = 0.362$) with RAC. Model 2 shows that FCI (β = -0.578, $p < 0.010$) negatively affects PAC, while IFM (β = 0.362, $p < 0.050$), BST (β = 0.627, $p < 0.010$), and RFB (β = 0.276, $p < 0.050$) positively affect PAC. EAFM has no effect on PAC. PAC (β = 0.453, $p < 0.010$) is positively related to GPI. Notably, the direct effects of FCI and BST are no longer significant, suggesting PAC fully mediates the relationship between these variables and GPI (Hayes, 2017). Model 3 shows similar patterns, but the direct effect of BST on GPI (β = 0.203, $p < 0.050$) remains significant, suggesting that RAC partially mediates the relationship between BST and GPI. We also observed differences in SEW dimensions' explanatory power across Models 2 and 3. The contribution of BST to the explained variance in RAC ($f^2 = 0.043$) is lower than its contribution to PAC ($f^2 = 0.094$). Additionally, BST explains more variance in GPI when RAC is the mediator ($f^2 = 0.042$) than when PAC is the mediator ($f^2 = 0.002$). Results are illustrated in Figures 3 and 4.

(Insert Table 6 and Figures 2, 3 and 4 here)

The key condition for determining the mediating effects of our structural model is to test the significance of the paths SEW dimensions→PAC/RAC and PAC/RAC→GPI (Hayes, 2017). The results reported in Table 7 indicate that the indirect effects of FCI (a_1 x b = -0.262, $p < 0.010$), IFM (a_2 x b = 0.164, $p < 0.050$), BST (a_3 x b = 0.284, $p < 0.010$) and RFB (a_5 x b = 0.125, $p < 0.100$) on GPI via PAC are significant. These results assume a partial mediation of PAC in the relationship between IFM and GPI and RFB and GPI since both the direct effects (c_2' = 0.123, $p < 0.050$ for IFM; c_5' = 0.143, $p < 0.010$ for RFB) and the indirect effects are significant. They also show that PAC fully mediates the relationship between FCI and GPI and BST and GPI. This is because the direct effects are not significant (c_1' = -0.061, $p > 0.100$ for

FCI; c_3' = 0.066, $p < 0.100$ for BST), whereas the indirect effects are significant. Additionally, we computed the variance accounted for (VAF) index which assesses the size of the indirect effect in relation to the direct effects. VAF values for the indirect effects of IFM (0.577) and RFB (0.473) via PAC met the threshold for partial mediation since they ranged between 0.200 and 0.800, while VAF values for the indirect effects of FCI (0.816) and BST (0.816) via PAC were above the minimum value of 0.800 for full mediation (Hair et al., 2012). Thus, hypotheses 2a and 2c are validated while hypotheses 2b and 2e are partially supported. However, hypothesis 2d is not confirmed since we only found a positive effect of EAFM ($a_4 = 0.132$, $p < 0.100$) on PAC in our analysis.

Table 8 reveals that the indirect effects of FCI (d_1 x e = -0.279, $p < 0.010$), IFM (d_2 x e = 0.171, $p < 0.050$), BST (d_3 x e = 0.147, $p < 0.100$) and RFB (d_5 x e = 0.113, $p < 0.100$) on GPI via RAC are significant. These results suggest that RAC partially mediates the relationship between IFM and GPI, BST and GPI and RFB and GPI since both the direct effects (f_2' = 0.115, $p < 0.100$ for IFM; f_3' = 0.203, $p < 0.010$ for BST; f_5' = 0.152, $p < 0.050$ for RFB) and the indirect effects are significant. VAF values for the indirect effects of IFM (0.602), BST (0.422) and RFB (0.428) on GPI via RAC further corroborate partial mediation as they range between 0.200 and 0.800. The results also show that RAC fully mediates the relationship between FCI and GPI since the direct effect of FCI (f_1' = -0.044; $p > 0.100$) on GPI is not significant, the indirect effect via RAC is significant and the VAF value (0.869) is higher than 0.800. Thus, hypothesis 3a is fully supported, whereas hypotheses 3b, 3c and 3e are partially validated. Again, only the direct effect of EAFM on RAC is significant ($d_4 = 0.149$, $p < 0.100$), leading us to reject hypothesis 3d.

(Insert Tables 7 and 8 here)

5.3 Robustness Checks

To ensure the robustness of our findings, we conducted several checks. First, we replicated our analysis using the causal-steps procedure with ordinary least squares regressions (Baron & Kenny, 1986). As shown in Table 9, the results confirmed the partial and full mediating effects reported in Tables 6, 7, and 8. Second, we repeated the analysis with an updated measure of GPI based on self-reported data from the same respondents in 2024, thereby reducing potential common method bias (Kock et al., 2021) and endogeneity concerns. Out of the 249 initial firms, 3 went bankrupt, and 14 declined further participation. The analysis on the remaining 232 firms yielded consistent results (available upon request). Third, we used an alternative GPI measure from 2024—the number of new green products launched over the last three years—reflecting the actual output of green innovation (Dangelico & Pujari, 2010). Following Cameron and Trivedi's (2013) guidelines, we conducted mediation analysis using negative binomial regressions for the outcome models and ordered logistic regressions for the mediator models. The results, shown in Table 10, aligned with our initial findings. Fourth, we tested whether firm size and age moderated the adoption of green innovation in family firms, as suggested by recent research (Aiello, Mannarino, & Pupo, 2023). However, no significant moderating effects were observed. We further analyzed subsamples of larger and older firms (above the mean for size and age) versus smaller and younger firms (below the mean). The results did not show any differences. Finally, we repeated the subsample analyses using the median instead of the mean, and again, no significant differences emerged.

(Insert Tables 9 and 10 here)

6 Discussion and Conclusion

To deepen our understanding of how family owners' nonfinancial priorities shape green innovation, we draw on the SEW perspective and offer a nuanced examination of how each of the FIBER dimensions contributes to heterogeneity in family firms' engagement with GPI. Our theoretical model and empirical results demonstrate that IFM, BST, and RFB are positively

associated with GPI. These findings suggest that family owners who value these SEW dimensions perceive GPI as a source of SEW gains, such as enhanced reputation and image, stronger social relationships, and increased long-term sustainability, making them more inclined to pursue environmentally focused innovation. Conversely, we find that FCI negatively affects GPI. This indicates that when family owners place strong emphasis on maintaining control over strategic and operational decisions, they may view GPI as a potential threat to SEW, particularly due to the perceived need to involve external human and financial resources, which could undermine the family's dominant position. As a result, these owners are less willing to engage in green innovation initiatives.

To further explore the underlying mechanisms through which the FIBER dimensions influence GPI, we incorporate PAC and RAC as key mediators. Our findings reveal that both PAC and RAC positively mediate the relationships between IFM, BST, and RFB and GPI. This suggests that family owners focused on safeguarding the firm's image, fostering stakeholder relationships, or ensuring transgenerational continuity are more inclined to acquire and assimilate new knowledge (PAC), as well as to transform and apply that knowledge (RAC), because they view these activities as aligned with their SEW objectives and conducive to achieving GPI. Importantly, we observe full mediation for the relationship between BST and GPI via PAC. This finding implies that the positive effect of BST on GPI operates entirely through the acquisition and assimilation of knowledge. A plausible explanation is that an emphasis on social capital accumulation encourages engagement with external stakeholders, leading to a significant influx of external knowledge that must be processed and integrated to influence GPI outcomes. In contrast, our results show that PAC and RAC negatively mediate the relationship between FCI and GPI. This indicates that when family owners prioritize control and influence, they are less inclined to pursue knowledge acquisition and exploitation activities due to the perceived risk such efforts pose to the family's decision-making dominance. Again,

we observe full mediation via PAC, suggesting that the negative impact of FCI on GPI can be entirely attributed to the reluctance to engage in knowledge acquisition and assimilation processes, which are viewed as potentially eroding SEW.

Interestingly, we find no significant relationship between EAFM and GPI, nor with PAC or RAC. One potential explanation lies in the inherent complexity of emotional dynamics in family firms, which may not be fully captured by a single psychometric measure. Emotions in family firms are multifaceted, and their impact on decision-making can vary depending on how they are experienced and managed. Prior research suggests that while family owners may attempt to minimize negative emotions and amplify positive ones in the short term, they may also tolerate short-term emotional discomfort if it supports long-term business survival. As such, a more detailed exploration of the emotional landscape in family firms could provide greater insight into how emotional attachment influences engagement with GPI, PAC, and RAC.

6.1 Implications

Our study makes several significant contributions to the family business and innovation literatures. First, while prior research has yielded mixed findings on family firms' innovation behaviors (Calabrò et al., 2019), this study addresses these inconsistencies by responding to recent calls for investigating how family firm-specific characteristics influence specific types of innovation (Hu & Hughes, 2020). Specifically, this article both theoretically and empirically examines the impact of SEW on green innovation, a topic that has led to conflicting views in the limited existing literature (Miroshnychenko et al., 2022). By acknowledging the multidimensional nature of SEW and analyzing the potential effects of the FIBER dimensions, we pave the way for reconciliation, overcoming a key limitation in prior research that has typically treated SEW as a unidimensional construct in green innovation studies (Bammens & Hünermund, 2020; Huang et al., 2016). In doing so, we enhance our understanding of how family-related factors contribute to variations in GPI across family firms, emphasizing the

importance of moving beyond a homogeneous view of family firms in relation to green innovation and adopting a more nuanced approach to analyzing this form of innovation.

At a broader level, by showing that the prioritization of specific SEW dimensions can lead to divergent GPI outcomes, this study contributes to the ongoing conversation on how family priorities may drive "polar extremes" in innovation strategies (Hsueh, De Massis, & Gómez-Mejía, 2023; Miller & Le Breton-Miller, 2021) and advances the debate on the innovation–tradition paradox in family firms (Villani et al., 2024). While prior literature has long portrayed SEW as a source of inertia—anchoring firms in tradition by promoting risk aversion, organizational rigidity, and hesitance toward technological investment (Calabrò et al., 2019), our study underscores the importance of acknowledging the heterogeneity in family owners' SEW preferences to better understand how family firms unlock their innovation potential. Beyond the constraining effect of FCI, other SEW dimensions, such as IFM, BST and RFB, appear to encourage GPI. Thus, some family firms, driven by owners' desire to maintain historic family dominance, adopt a conservative stance toward innovation. In contrast, when the focus shifts to preserving other traditional dimensions, such as family and business identity, enduring social ties with stakeholders, or a transgenerational legacy, these firms often embrace a more proactive innovation strategy. Our findings therefore highlight that, under specific SEW-related conditions, tradition and innovation are not inherently at odds but can coexist in a complementary way. In doing so, we emphasize the need to move beyond generalized assumptions about the role of tradition in shaping innovation behavior in family firms (Villani et al., 2024).

Second, while the literature on family firm innovation has largely emphasized the ambivalent influence of SEW on innovation decisions (Bauweraerts et al., 2022), few studies have added nuance to this debate by examining the underlying mechanisms through which family owners' SEW preferences shape heterogeneous innovation behaviors (Filser et al., 2016). In particular,

knowledge management mechanisms, despite their recognized importance for innovation, have received limited attention, especially regarding the tensions they may generate with SEW preservation (Kotlar et al., 2020). This article advances the conversation by identifying PAC and RAC as key mediating factors that help explain how distinct SEW preferences translate into green innovation. While our findings are consistent with prior research indicating that both dimensions of AC support GPI (Aboelmaged & Hashem, 2019), they also reveal a more nuanced picture: FCI negatively influences both PAC and RAC, whereas IFM, BST, and RFB have a positive effect on both capabilities. Accordingly, our study underscores that GPI in family firms can emerge through multiple pathways, with PAC and RAC serving as critical mechanisms linking specific SEW priorities to divergent innovation outcomes (Villani et al., 2024). Furthermore, our analysis sheds light on the often-overlooked role of family owners in shaping AC—an area traditionally centered on manager-level antecedents in widely held firms (Kotlar et al., 2020). By focusing on private family firms, where owners exert a more direct and emotionally driven influence on decision-making, this research contributes to a deeper understanding of how nonfinancial motives drive AC variability and, ultimately, innovation in family businesses.

Third, this study contributes to the SEW literature by extending the application of the SEW perspective to better understand its influence on specific forms of innovation and knowledge management capabilities. While prior research has often aggregated SEW dimensions to make broad predictions about family firm green innovation and AC, our conceptual framework leverages the FIBER model to argue that the extent of GPI and AC is contingent upon the value family owners assign to distinct SEW dimensions. In doing so, we embrace the complex and ambivalent nature of SEW to offer a more nuanced understanding of how heterogeneous SEW priorities shape both GPI and AC. Furthermore, by employing direct measures of SEW dimensions to assess their influence on GPI, we complement prior studies that have relied on

distal proxies, such as family involvement in ownership and management, to infer the effects of SEW on green innovation behaviors (Chen, Pan, & Sinha, 2022; Huang et al., 2016). Our approach thus provides greater empirical precision regarding the actual influence of family owners' nonfinancial priorities on specific innovation behaviors. Additionally, in line with recent research (Bauweraerts et al., 2022; Ng et al., 2019), our study offers further support for the FIBER model as a robust tool to capture the multidimensionality of the SEW construct, addressing ongoing calls for more replication studies to refine SEW measurement (Gómez-Mejía & Herrero, 2022).

Beyond its theoretical contributions, this study offers important managerial implications. In today's increasingly dynamic and sustainability-driven economic landscape, family business owners and managers are increasingly viewing GPI as a strategic avenue for building long-term competitive advantage. Our findings suggest that to foster GPI, family firms should align their AC development strategies with their specific SEW priorities. For family owners focused on reputation, stakeholder relationships, or transgenerational continuity, investing in mechanisms that strengthen both PAC and RAC is essential. For instance, cross-functional collaboration across departments can foster the integration of diverse perspectives, enhancing the firm's ability to identify valuable external knowledge and translate it into practical innovation strategies, while also ensuring that employees remain deeply committed to the family business. External partnerships with universities, research institutions, or other businesses provide access to cutting-edge knowledge, which can be transformed into innovations that align with the firm's values and meet market demands, helping family firms maintain a competitive edge and protect their reputation. Furthermore, internal training programs that expose employees to emerging trends, technologies, and best practices equip them with the skills necessary to recognize and integrate valuable external knowledge into the firm's products and operations, thereby promoting the development of a sustainable competitive advantage that ensures the continuity

of the family business across generations. In contrast, firms that prioritize family control may need to adopt knowledge integration and transformation practices that maintain family decision-making authority. For example, forming family-led innovation teams could help explore external ideas and ensure acquired knowledge is adapted and used in ways that align with the family's values. Collaborating with trusted external advisors can also help balance control with the need to effectively absorb and utilize external knowledge to navigate industry challenges or market shifts. These strategies, tailored to the SEW priorities of family owners, may also be of interest to policymakers seeking to activate levers of green innovation to support the sustainable development of family firms. Specifically, such insights could be integrated into supranational policy initiatives, contributing to the ongoing dialogue within regulatory and business communities, such as the European Union's research and innovation strategy.

6.2 Limitations and Future Research

Our study has several limitations that open avenues for future research. First, while focusing on a single country allows us to isolate the hypothesized relationships from confounding institutional factors, it may also limit the generalizability of our findings to other contexts. Although we do not anticipate major differences between Belgium and other Western countries, cultural factors, especially in national cultures that differ significantly from Belgium (Hofstede, 2001), may influence the observed dynamics. We therefore encourage future research to replicate our study in diverse geographical settings to test the robustness of our results. Second, our study relies on cross-sectional data, which constrains our ability to examine the temporal dynamics of family ownership and their impact on AC and GPI. This is a critical limitation, as prior studies have highlighted that the evolution of family ownership—such as its duration and succession processes—can significantly shape how innovation decisions are framed and evaluated (Kotlar et al., 2020). Longitudinal studies would thus be well-suited to capture these temporal effects more accurately. Although we attempted to mitigate reverse causality by

replicating our analysis with a time lag between the independent and dependent variables, our cross-sectional design still raises potential endogeneity concerns related to simultaneity (Zaefarian et al., 2017). Moreover, family firms are embedded in complex systems characterized by numerous unobserved variables that are difficult to measure or proxy, such as intra-family dynamics, informal power structures, or emotional attachments. These unobserved factors can lead to endogeneity issues, including omitted variable bias and measurement error. While advances in research methods and econometric techniques have aimed to address such challenges, they typically require sensitive family-specific data, which is often hard to obtain due to privacy concerns (Zhang et al., 2022; Carney et al., 2015). We therefore call for continued methodological innovation to better address endogeneity in family firm research. Third, our data were collected from single informants. While this approach is common in survey research (Simon & Shrader, 2012) and we took several steps to reduce common method bias, future research should aim to validate our findings using multiple informants within each organization to enhance data reliability. Fourth, our study focuses specifically on GPI and does not examine how SEW priorities influence other forms of green innovation, such as green process innovation, green organizational practices, or green patenting. Further research is needed to explore whether variation in family owners' nonfinancial goals contributes to heterogeneity in green innovation strategies across different domains. Fifth, although our study supports the validity of the FIBER model as a multidimensional representation of SEW, debates remain regarding its dimensional structure and overlap with other operationalizations such as SEWi (Debicki et al., 2016), REI (Hauck et al., 2016), and FIRE (Naldi et al., 2024). Future studies could leverage these alternative scales to examine whether different measures of SEW dimensions yield converging or diverging results on GPI outcomes. To complement our focus on the individual effects of SEW dimensions, configurational approaches such as fuzzy set qualitative comparative analysis (fsQCA) could be employed to explore how specific

combinations of SEW priorities influence GPI (Hsueh et al., 2023). Finally, the timeframe of our dataset did not allow us to capture the potential impact of exogenous shocks, such as economic or environmental crises, into our conceptual model. This represents a promising direction for future research, given that strategic decision-making in family firms often shifts during crises, with SEW and financial goals converging toward firm survival (Gómez-Mejía Patel, & Zellweger, 2018). In such contexts, family firms may adjust their levels of PAC and RAC to cope with turbulent environments, potentially leading to variations in GPI.

Endnote

1. For the sake of conciseness, the results of the exploratory factor analysis are not reported in the text but are available from the authors upon request.

Ethics Statement

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

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Table 1. Reliability and validity tests for the constructs

Constructs	Indicators	Loadings	α	CR	AVE
Green product innovation (*GPI*)	GPI1. My company chooses the materials of the product that produce the least amount of pollution for conducting the product development or design.	0.876	0.823	0.780	0.755
	GPI2. My company chooses the materials of the product that consume the least amount of energy and resources for conducting the product development or design.	0.846			
	GPI3. My company uses the fewest amount of materials to comprise the product for conducting the product development or design.	0.864			
	GPI4. My company would circumspectly deliberate whether the product is easy to recycle, reuse, and decompose for conducting the product development or design.	0.888			
Family control and influence (*FCI*)	FCI1. In my family business, family members exert control over strategic decisions.	0.902	0.864	0.796	0.775
	FCI2. Preservation of family control and independence are important goals for my family business.	0.898			
	FCI3. In my family business, most executive positions are occupied by family members.	0.847			
	FCI4. In my family business, nonfamily managers and directors are named by family members.	0.869			
	FCI5. The board of directors is mainly composed of family members.	0.884			
Identification of family members (*IFM*)	IFM1. Family members have a strong sense of belonging to my family business.	0.877	0.819	0.767	0.739
	IFM2. Family members feel that the family business' success is their own success.	0.845			
	IFM3. My family business has a great deal of personal meaning for family members.	0.867			
	IFM4. Being a member of the family business helps define who we are.	0.847			
	IFM5. Family members are proud to tell others that we are part of the family business.	0.861			
Binding social ties (*BST*)	BST1. My family business is very active in promoting social activities at the community level.	0.875	0.858	0.794	0.772
	BST2. In my family business, nonfamily employees are treated as part of the family.	0.884			
	BST3. In my family business, contractual relationships are mainly based on trust and norms of reciprocity.	0.892			
	BST4. Building strong relationships with other institutions (i.e., other companies, professional associations, government agencies, etc.) is important for my family business.	0.864			
Emotional attachment of family members (*EAFM*)	EAFM1. Emotions and sentiments often affect decision-making processes in my family business.	0.887	0.834	0.779	0.754
	EAFM2. Protecting the welfare of family members is critical to us, apart from personal contributions to the business.	0.854			
	EAFM3. In my family business, the emotional bonds between family members are very strong	0.871			
	EAFM4. In my family business, affective considerations are often as important as economic considerations.	0.860			
Renewal of family bonds (*RFB*)	RFB1. Continuing the family legacy is an important goal for my family business.	0.847	0.852	0.789	0.766
	RFB2. Family owners are less likely to evaluate their investment on a short-term basis.	0.890			
	RFB3. Family members would be unlikely to consider selling the family business.	0.888			
	RFB4. Successful business transfer to the next generation is an important goal for family members.	0.876			
Potential absorptive capacity (PAC)					
Knowledge acquisition	PAC1. The search for relevant information concerning our industry is every-day business in our company.	0.887	0.898	0.800	0.780
	PAC2. Our management motivates the employees to use information sources within our industry.	0.879			
Knowledge assimilation	PAC3. In our company ideas and concepts are communicated cross-departmental.	0.877	0.841	0.783	0.758
	PAC4. Our management emphasizes cross-departmental support to solve problems.	0.849			
	PAC5. In our company there is a quick information flow, e.g., if a business unit obtains important information it communicates this information promptly to all other business units or departments.	0.875			
	PAC6. Our management demands periodical cross-departmental meetings to interchange new developments, problems, and achievements.	0.882			
Realized absorptive capacity (RAC)					
Knowledge exploitation	RAC1. Our management supports the development of prototypes.	0.875	0.823	0.770	0.743
	RAC2. Our company regularly reconsiders technologies and adapts them accordant to new knowledge.	0.847			
	RAC3. Our company has the ability to work more effective by adopting new technologies.	0.864			
Knowledge transformation	RAC4. Our employees have the ability to structure and to use collected knowledge.	0.871	0.839	0.782	0.757
	RAC5. Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available.	0.864			
	RAC6. Our employees successfully link existing knowledge with new insights.	0.859			
	RAC7. Our employees are able to apply new knowledge in their practical work	0.886			

Notes: α: Cronbach's α; CR: composite reliability; AVE: average variance extracted.

Table 2. Discriminant validity analysis of the first order constructs.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. GPI	**0.875**															
2. FCI	0.152**	**0.883**														
3. IFM	0.141**	0.145**	**0.862**													
4. BST	0.155**	0.122*	0.210***	**0.885**												
5. EAFM	0.083	0.113*	0.165**	0.154**	**0.87**											
6. RFB	0.152**	0.140**	0.126*	0.146**	0.152**	**0.884**										
7. Knowledge acquisition	0.258***	-0.230***	0.152**	0.355***	0.121*	0.149**	**0.883**									
8. Knowledge assimilation	0.264***	-0.284***	0.164**	0.347***	0.132*	0.152**	0.248***	**0.878**								
9. Knowledge exploitation	0.243***	-0.258***	0.145**	0.148**	0.124*	0.157**	0.127*	0.131*	**0.865**							
10. Knowledge transformation	0.235***	-0.247***	0.154**	0.156**	0.126*	0.145**	0.132*	0.122*	0.261***	**0.878**						
11. Firm age	-0.156**	-0.256***	-0.164**	-0.155*	-0.254***	-0.145**	-0.119*	-0.124*	-0.112*	-0.122*	**1.000**					
12. Firm size	0.095	-0.123*	-0.145**	-0.152**	-0.125*	-0.092	-0.080	-0.094	-0.075	-0.089	-0.120*	**1.000**				
13. Family CEO	0.124*	0.292***	0.212***	0.206***	0.226***	0.243***	-0.101	-0.085	-0.065	-0.085	-0.083	-0.149**	**1.000**			
14. GC	0.083	-0.128*	-0.156**	-0.124*	-0.205***	-0.192***	-0.082	-0.072	-0.128*	-0.092	-0.085	0.147**	-0.145**	**1.000**		
15. Gen Inv	0.312***	0.146**	-0.147**	-0.132**	0.122*	0.223***	0.143**	0.166**	0.146**	0.154**	-0.098	0.156**	0.204***	0.312***	**1.000**	
16. Secondary sector	0.145**	0.082	0.065	0.092	0.078	0.064	0.074	0.055	0.067	0.091	0.154**	0.153**	-0.118*	0.085	0.052	**1.000**

Notes: GPI: Green product innovation; FCI: family control and influence; IFM: identification of family members; BST: binding social ties; EAFM: emotional attachment of family members; RFB: renewal of family bonds: Generation in control; Gen Inv: Generational involvement; bold numbers on the diagonal indicate the square root of the average variance extracted; in the regression model; *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Table 3. Heterotrait-monotrait ratios (HTMT) of the first-order construct

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. GPI	n.a.															
2. FCI	0.223	n.a.														
3. IFM	0.204	0.209	n.a.													
4. BST	0.215	0.188	0.354	n.a.												
5. EAFM	0.126	0.162	0.242	0.235	n.a.											
6. RFB	0.217	0.210	0.183	0.202	0.224	n.a.										
7. Knowledge acquisition	0.428	0.350	0.238	0.553	0.182	0.202	n.a.									
8. Knowledge assimilation	0.481	0.427	0.246	0.530	0.193	0.222	0.365	n.a.								
9. Knowledge exploitation	0.434	0.388	0.215	0.215	0.182	0.215	0.172	0.195	n.a.							
10. Knowledge transformation	0.425	0.393	0.224	0.221	0.186	0.204	0.195	0.174	0.395	n.a.						
11. Firm age	0.223	0.412	0.245	0.228	0.375	0.198	0.156	0.189	0.165	0.187	n.a.					
12. Firm size	0.142	0.186	0.207	0.216	0.174	0.138	0.122	0.158	0.112	0.126	-0.120	n.a.				
13. Family CEO	0.182	0.495	0.302	0.315	0.310	0.389	0.153	0.128	0.093	0.115	-0.083	-0.149	n.a.			
14. GC	0.122	0.184	0.212	0.177	0.305	0.285	0.125	0.115	0.184	0.132	-0.085	0.147	-0.145	n.a.		
15. Gen Inv	0.512	0.215	0.209	0.198	0.189	0.334	0.212	0.242	0.209	0.220	-0.098	0.156	0.204	0.312	n.a.	
16. Secondary sector	0.212	0.136	0.111	0.147	0.132	0.095	0.105	0.072	0.097	0.147	0.154	0.153	-0.118	0.085	0.052	n.a.

Notes: GPI: Green product innovation; FCI: family control and influence; IFM: identification of family members; BST: binding social ties; EAFM: emotional attachment of family members; RFB: renewal of family bonds; GC: Generation in control; Gen Inv: Generational involvement; n.a.: not applicable.

Table 4. Weights, T-statistics and VIFs for second-order constructs.

Construct	Weight	T-statistic	VIF
Potential absorptive capacity (PAC)			
Knowledge acquisition	0.523***	6.234	1.023
Knowledge assimilation	0.684***	9.873	1.134
Realized absorptive capacity (RAC)			
Knowledge exploitation	0.467***	4.087	1.475
Knowledge transformation	0.646***	8.745	1.528

Notes: *$p < 0.100$; **$p < 0.050$; ***$p < 0.010$.

Table 5. Latent variable correlations of the structural model.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. GPI	1.00													
2. FCI	0.152**	1.00												
3. EAFM	0.141**	0.145**	1.00											
4. IFM	0.155**	0.122*	0.210***	1.00										
5. BST	0.083	0.113*	0.165**	0.154**	1.00									
6. RFB	0.152**	0.140**	0.126*	0.146**	0.152**	1.00								
7. PAC	0.267***	-0.247***	0.142**	0.349***	0.136*	0.158**	1.00							
8. RAC	0.238***	-0.245***	0.143**	0.148**	0.125*	0.146**	0.243***	1.00						
9. Firm age	-0.156**	-0.256***	-0.164**	-0.155*	-0.254***	-0.145**	-0.112*	-0.147**	1.00					
10. Firm size	0.095	-0.123*	-0.145**	-0.152**	-0.125*	-0.092	-0.075	-0.075	-0.120*	1.00				
11. Family CEO	0.124*	0.292***	0.212***	0.206***	0.226***	0.243***	-0.095	-0.065	-0.083	-0.149**	1.00			
12. GC	0.083	-0.128*	-0.156**	-0.124*	-0.205***	-0.192***	-0.078	-0.086	-0.085	0.147**	-0.145**	1.00		
13. Gen Inv	0.312***	0.146**	-0.147**	-0.132**	0.122*	0.223***	0.154**	0.168**	-0.098	0.156**	0.204***	0.312***	1.00	
14. Secondary sector	0.145**	0.082	0.065	0.092	0.078	0.064	0.086	0.075	0.154**	0.153**	-0.118*	0.085	0.052	1.00

Notes: GPI: Green product innovation; FCI: family control and influence; EAFM: emotional attachment of family members; IFM: identification of family members; BST: binding social ties; RFB: renewal of family bonds; PAC: Potential absorptive capacity; RAC: Realized absorptive capacity; GC: Generation in control; Gen Inv: Generational involvement; *$p < 0.100$; **$p < 0.050$; ***$p < 0.010$.

Table 6. Structural model results.

	Model 1				Model 2				Model 3			
Path	Estimate	T-statistics	f^2	VIF	Estimate	T-statistics	f^2	VIF	Estimate	T-statistics	f^2	VIF
FCI→GPI	-0.321**	1.787	0.041	1.025	-0.061	0.242	0.002	1.042	-0.044	0.108	0.005	1.052
IFM→GPI	0.284**	1.764	0.043	1.087	0.123**	1.664	0.054	1.111	0.115*	1.494	0.024	1.100
BST→GPI	0.348**	1.804	0.042	1.158	0.066	0.247	0.002	1.198	0.203**	1.708	0.042	1.203
EAFM→GPI	0.108	0.266	0.004	1.062	0.051	0.223	0.004	1.097	0.046	0.184	0.003	1.104
RFB→GPI	0.264**	1.745	0.060	1.132	0.143**	1.689	0.055	1.155	0.152**	1.694	0.065	1.172
FCI→PAC					-0.578***	5.365	0.089	1.143				
IFM→PAC					0.362**	1.824	0.041	1.082				
BST→PAC					0.627***	6.582	0.094	1.029				
EAFM→PAC					0.132	1.574	0.005	1.084				
RFB→PAC					0.276**	1.769	0.045	1.095				
PAC→GPI					0.453***	4.186	0.103	1.147				
FCI→RAC									-0.661***	5.957	0.102	1.132
IFM→RAC									0.405**	1.941	0.045	1.065
BST→RAC									0.348**	1.817	0.043	1.122
EAFM→RAC									0.149	1.593	0.004	1.231
RFB→RAC									0.268**	1.749	0.046	1.146
RAC→GPI									0.422***	6.545	0.102	1.137
Firm age→GPI	-0.201**	1.703	0.022	1.872	-0.194**	1.692	0.028	1.988	-0.190**	1.678	0.023	1.965
Firm size→GPI	-0.084	0.317	0.003	1.203	-0.076	0.256	0.002	1.246	-0.082	0.295	0.007	1.232
Family CEO→GPI	0.194**	1.697	0.032	1.184	0.178**	1.667	0.035	.1.223	0.173**	1.657	0.032	1.203
GC→GPI	0.094	0.402	0.004	1.648	0.076	0.305	0.003	1.692	0.082	0.353	0.008	1.724
Gen Inv→GPI	0.489***	3.017	0.081	1.606	0.417***	2.987	0.084	1.645	0.425***	3.052	0.081	1.627
Secondary sector→GPI	0.184**	1.686	0.025	1.138	0.196**	1.725	0.032	1.156	0.189**	1.706	0.029	1.148
R^2 GPI	0.326				0.371				0.362			
R^2 PAC					0.264							
R^2 RAC									0.237			
Q^2 GPI	0.174				0.242				0.229			
Q^2 PAC					0.126							
Q^2 RAC									0.118			

Notes: GPI: Green product innovation; FCI: family control and influence; EAFM: emotional attachment of family members; IFM: identification of family members; BST: binding social ties; RFB: renewal of family bonds PAC: Potential absorptive capacity; GC: Generation in control; Gen Inv: Generational involvement; *$p < 0.100$; **$p < 0.050$; ***$p < 0.010$ (one-tailed).

Table 7. Summary of mediating effect tests with potential absorptive capacity as a mediator.

Total effect on green innovation				Direct effect on green innovation				Indirect effect on green innovation				
	Path	t	Percentile bootstrap 95% CI		Path	t	Percentile bootstrap 95% CI		Path	t	Percentile bootstrap 95% CI	VAF
FCI-GPI (c_1)	-0.321**	1.787	[0.181; 0.462]	FCI-GPI (c_1')	-0.061	0.242	[-0.086; 0.208]	FCI-PAC-GPI (a_1b)	-0.262***	3.514	[0.143; 0.380]	0.816
IFM-GPI (c_2)	0.284**	1.764	[0.153; 0.412]	IFM-GPI (c_2')	0.123**	1.664	[0.054; 0.192]	IFM-PAC-GPI (a_2b)	0.164**	1.724	[0.073; 0.251]	0.577
BST-GPI (c_3)	0.348**	1.804	[0.173; 0.424]	BST-GPI (c_3')	0.066	0.247	[-0.103; 0.222]	BST-PAC-GPI (a_3b)	0.284***	3.217	[0.194; 0.370]	0.816
EAFM-GPI (c_4)	0.108	0.266	[-0.055; 0.261]	EAFM-GPI (c_4')	0.051	0.223	[-0.134; 0.237]	EAFM-PAC-GPI (a_4b)	0.060	0.185	[-0.126; 0.241]	0.556
RFB-GPI (c_5)	0.264**	1.745	[0.164; 0.362]	RFB-GPI (c_5')	0.143**	1.689	[0.091; 0.192]	RFB-PAC-GPI (a_5b)	0.125*	1.574	[0.048; 0.227]	0.473

Notes: GPI: Green product innovation; FCI: family control and influence; EAFM: emotional attachment of family members; IFM: identification of family members; BST: binding social ties; RFB: renewal of family bonds PAC: Potential absorptive capacity; GC: Generation in control; Gen Inv: Generational involvement; CI: confidence intervals. Bootstrapping 95% confidence intervals in square brackets (based on n = 5,000 bootstrap runs); VAF: variance accounted for; *$p < 0.100$ **$p < 0.050$; ***$p < 0.010$ (one-tailed).

Table 8. Summary of mediating effect tests with realized absorptive capacity as a mediator.

Total effect on green innovation				Direct effect on green innovation				Indirect effect on green innovation				
	Path	t	Percentile bootstrap 95% CI		Path	t	Percentile bootstrap 95% CI		Path	t	Percentile bootstrap 95% CI	VAF
FCI-GPI (c_1)	-0.321**	1.787	[0.183; 0.464]	FCI-GPI (f_1')	-0.044	0.108	[-0.190; 0.112]	FCI-RAC-GPI (d_1e)	-0.279***	3.214	[0.203; 0.352]	0.869
IFM-GPI (c_2)	0.284**	1.764	[0.154; 0.43]	IFM-GPI (f_2')	0.115*	1.494	[0.032; 0.273]	IFM-RAC-GPI (d_2e)	0.171**	1.694	[0.103; 0.241]	0.602
BST-GPI (c_3)	0.348**	1.804	[0.176; 0.424]	BST-GPI (f_3')	0.203**	1.708	[0.124; 0.285]	BST-RAC-GPI (d_3e)	0.147*	1.518	[0.034;0.267]	0.422
EAFM-GPI (c_4)	0.108	0.266	[-0.056; 0.264]	EAFM-GPI (fc_4')	0.046	0.184	[-0.062; 0.151]	EAFM-RAC-GPI (d_4e)	0.063	0.214	[-0.084; 0.205]	0.583
RFB-GPI (c_5)	0.264**	1.745	[0.167; 0.362]	RFB-GPI (f_5')	0.152**	1.694	[0.083; 0.224]	RFB-RAC-GPI (d_5e)	0.113*	1.427	[0.023; 0.202]	0.428

Notes: GPI: Green product innovation; FCI: family control and influence; EAFM: emotional attachment of family members; IFM: identification of family members; BST: binding social ties; RFB: renewal of family bonds RAC: Realized absorptive capacity; GC: Generation in control; Gen Inv: Generational involvement; CI: confidence intervals. Bootstrapping 95% confidence intervals in square brackets (based on n = 5,000 bootsrap runs); VAF: variance accounted for; *$p < 0.100$; **$p < 0.050$; ***$p < 0.010$ (one-tailed).

Table 9. Mediation analysis via ordinary least squares regressions.

Variable	Model 4 DV: GPI	Model 5 DV: PAC	Model 6 DV: GPI	Model 8 DV: RAC	Model 9 DV: GPI
Firm age	-0.197**	-0.142*	-0.186**	-0.138*	-0.175**
	(0.062)	(0.065)	(0.058)	(0.061)	(0.052)
Firm size	-0.084	-0.069	-0.072	-0.063	-0.080
	(0.070)	(0.054)	(0.059)	(0.051)	(0.064)
Family CEO	0.194**	0.084*	0.187**	0.091*	0.175**
	(0.048)	(0.034)	(0.042)	(0.038)	(0.040)
GC	0.097	0.062	0.090	0.067	0.082
	(0.075)	(0.053)	(0.072)	(0.058)	(0.065)
Gen Inv	0.365***	0.217***	0.350***	0.222***	0.371***
	(0.052)	(0.032)	(0.049)	(0.035)	(0.058)
Secondary sector	0.145***	0.085	0.129***	0.077	0.137***
	(0.004)	(0.064)	(0.003)	(0.059)	(0.004)
FCI	-0.317**	-0.523***	-0.058	-0.656***	-0.041
	(0.089)	(0.092)	(0.038)	(0.106)	(0.030)
IFM	0.267**	0.354**	0.126**	0.397**	0.108*
	(0.067)	(0.087)	(0.035)	(0.092)	(0.046)
BST	0.335**	0.632***	0.062	0.336**	0.196**
	(0.094)	(0.057)	(0.045)	(0.099)	(0.041)
EAFM	0.096	0.115	0.078	0.138	0.082
	(0.085)	(0.094)	(0.066)	(0.098)	(0.070)
RFB	0.252***	0.267**	0.132**	0.264**	0.145**
	(0.023)	(0.072)	(0.034)	(0.067)	(0.039)
PAC			0.448***		
			(0.076)		
RAC					0.417***
					(0.065)
Constant	0.235***	0.175***	0.243***	0.147***	0.226***
	(0.017)	(0.007)	(0.019)	(0.009)	(0.015)
Adjusted R^2	0.374	0.341	0.394	0.336	0.382
F-stat	6.157***	5.759***	6.234***	5.657***	6.223***
N	249	249	249	249	249

Notes: DV: Dependent Variable; GPI: Green product innovation; FCI: family control and influence; IFM: identification of family members; BST: binding social ties; EAFM: emotional attachment of family members; RFB: renewal of family bonds RAC: Realized absorptive capacity; GC: Generation in control; Gen Inv: Generational involvement; *$p < 0.100$; **$p < 0.050$; ***$p < 0.010$; standard errors are reported within bracket.

Table 10. Mediation analysis with the number of new green products launched over the last three years as an alternative measure of GPI.

Variable	Model 10 DV: GPI	Model 11 DV: PAC	Model 12 DV: GPI	Model 13 DV: RAC	Model 14 DV: GPI
Firm age	-0.127**	-0.106*	-0.120**	-0.097*	-0.114**
	(0.031)	(0.040)	(0.029)	(0.039)	(0.028)
Firm size	-0.057	-0.039	-0.051	-0.049	-0.063
	(0.046)	(0.032)	(0.041)	(0.038)	(0.054)
Family CEO	0.147**	0.076*	0.151**	0.072*	0.140**
	(0.033)	(0.031)	(0.038)	(0.030)	(0.031)
GC	0.065	0.048	0.067	0.044	0.057
	(0.049)	(0.040)	(0.050)	(0.038)	(0.050)
Gen Inv	0.236***	0.198***	0.224***	0.175***	0.218***
	(0.031)	(0.022)	(0.041)	(0.018)	(0.016)
Secondary sector	0.109***	0.084	0.117***	0.090	0.099***
	(0.003)	(0.057)	(0.003)	(0.066)	(0.003)
FCI	-0.297**	-0.419***	-0.046	-0.508***	-0.036
	(0.064)	(0.056)	(0.042)	(0.084)	(0.020)
IFM	0.232**	0.307**	0.095**	0.335**	0.084*
	(0.042)	(0.082)	(0.023)	(0.097)	(0.035)
BST	0.294**	0.471***	0.047	0.268**	0.124**
	(0.083)	(0.047)	(0.036)	(0.056)	(0.032)
EAFM	0.067	0.098	0.059	0.105	0.055
	(0.056)	(0.089)	(0.050)	(0.096)	(0.048)
RFB	0.220***	0.203**	0.089**	0.198**	0.076**
	(0.019)	(0.041)	(0.021)	(0.043)	(0.018)
PAC			0.319***		
			(0.042)		
RAC					0.278***
					(0.027)
Constant	-0.575***		-0.657***		-0.689***
	(0.025)		(0.035)		(0.039)
/cut 1		1.256		1.217	
		(0.987)		(0.954)	
/cut 2		1.678		1.631	
		(1.123)		(1.105)	
/cut 3		1.921		1.909	
		(1.436)		(1.412)	
/cut 4		2.085		2.033	
		(1.677)		(1.637)	
LR χ^2	7.68***	6.74***	8.38***	6.80***	8.66**
Pseudo R^2	0.288	0.264	0.296	0.272	0.301
Log Likelihood	-725.52	-664.53	-768.64		-789.58
N	232	232	232	232	232

Notes: DV: Dependent Variable; GPI: Green product innovation; FCI: family control and influence; IFM: identification of family members; BST: binding social ties; EAFM: emotional attachment of family members; RFB: renewal of family bonds RAC: Realized absorptive capacity; GC: Generation in control; Gen Inv: Generational involvement; *$p < 0.100$; **$p < 0.050$; ***$p < 0.010$; standard errors are reported within bracket; negative binomial regressions are used un models 10, 12 and 14; ordered logistic regressions are used in models 11 and 12.

Figure 1. Mediation model

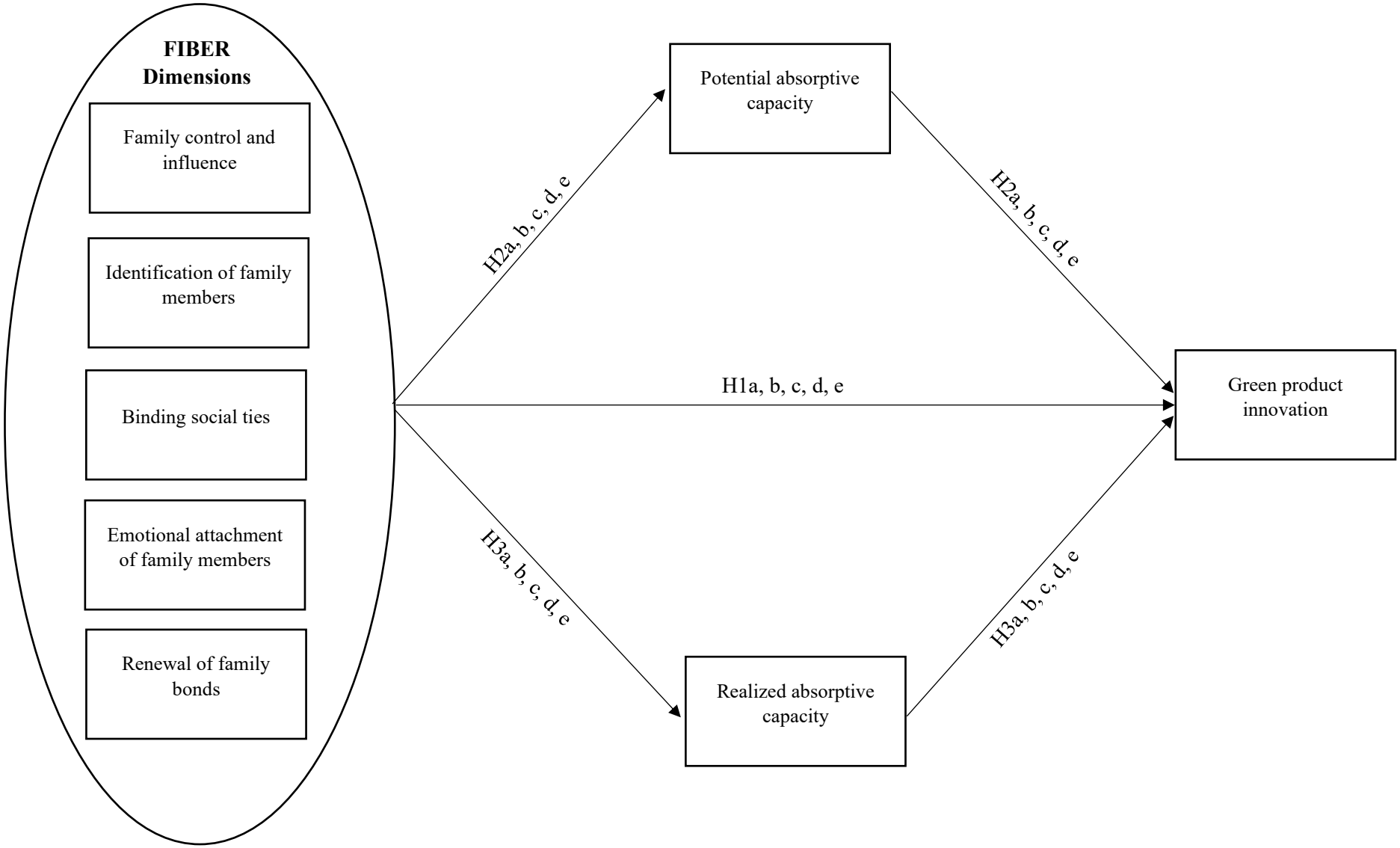

Figure 2. Results of model with total effects illustrating the relationships between SEW dimensions and green product innovation (Model 1). The values in the figure represent standardized coefficients. Paths between indicators, latent variables, and control variables are excluded for clarity. *p < 0.100, **p < 0.050, ***p <0 .010 (one-tailed).

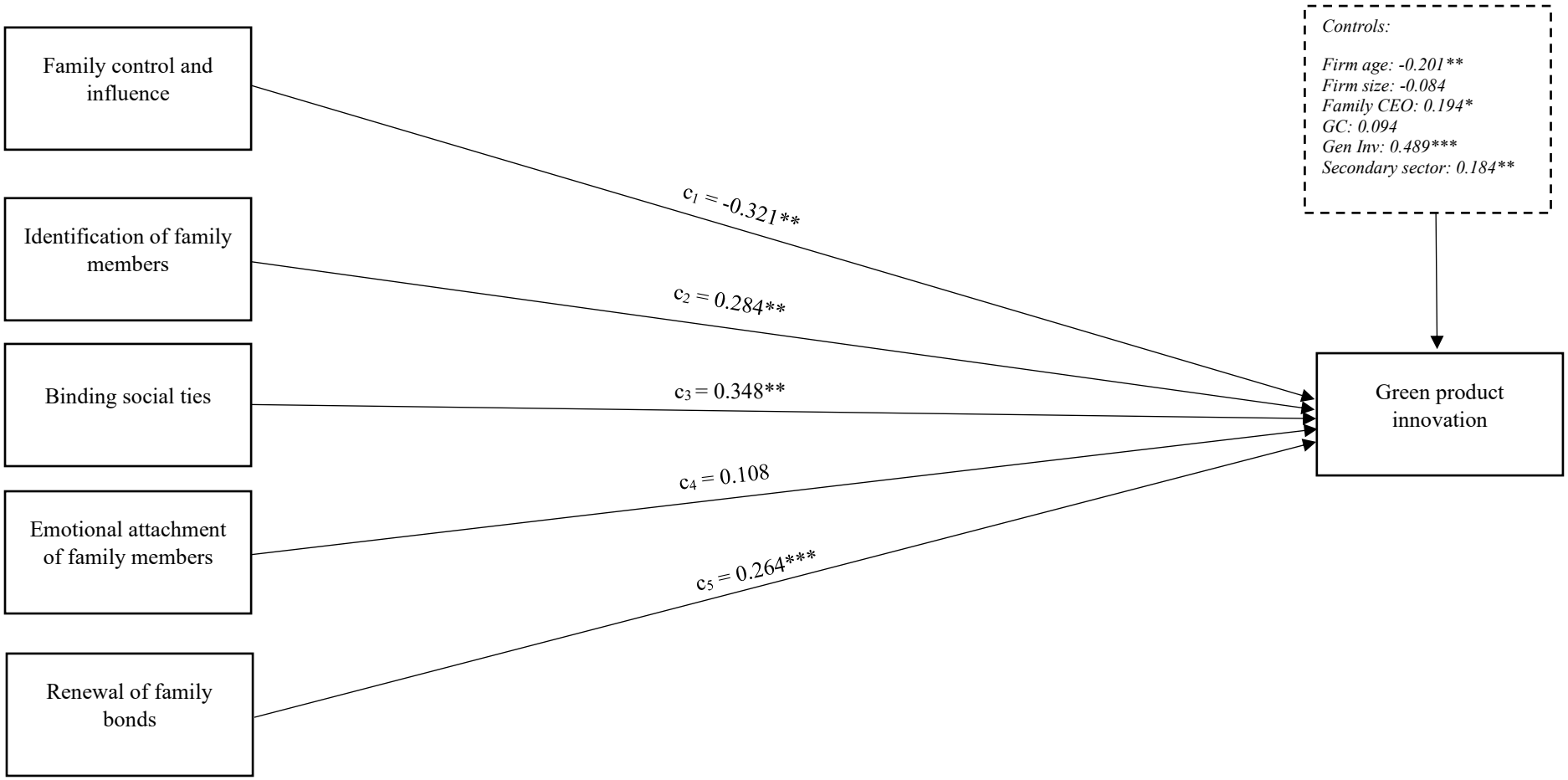

Figure 3. Results of mediated model illustrating the relationships among SEW dimensions, potential absorptive capacity and green product innovation (Model 2). The values in the figure represent standardized coefficients. Paths between indicators, latent variables, and control variables are excluded for clarity. *p < 0.100, **p < 0.050, ***p < 0.010 (one-tailed).

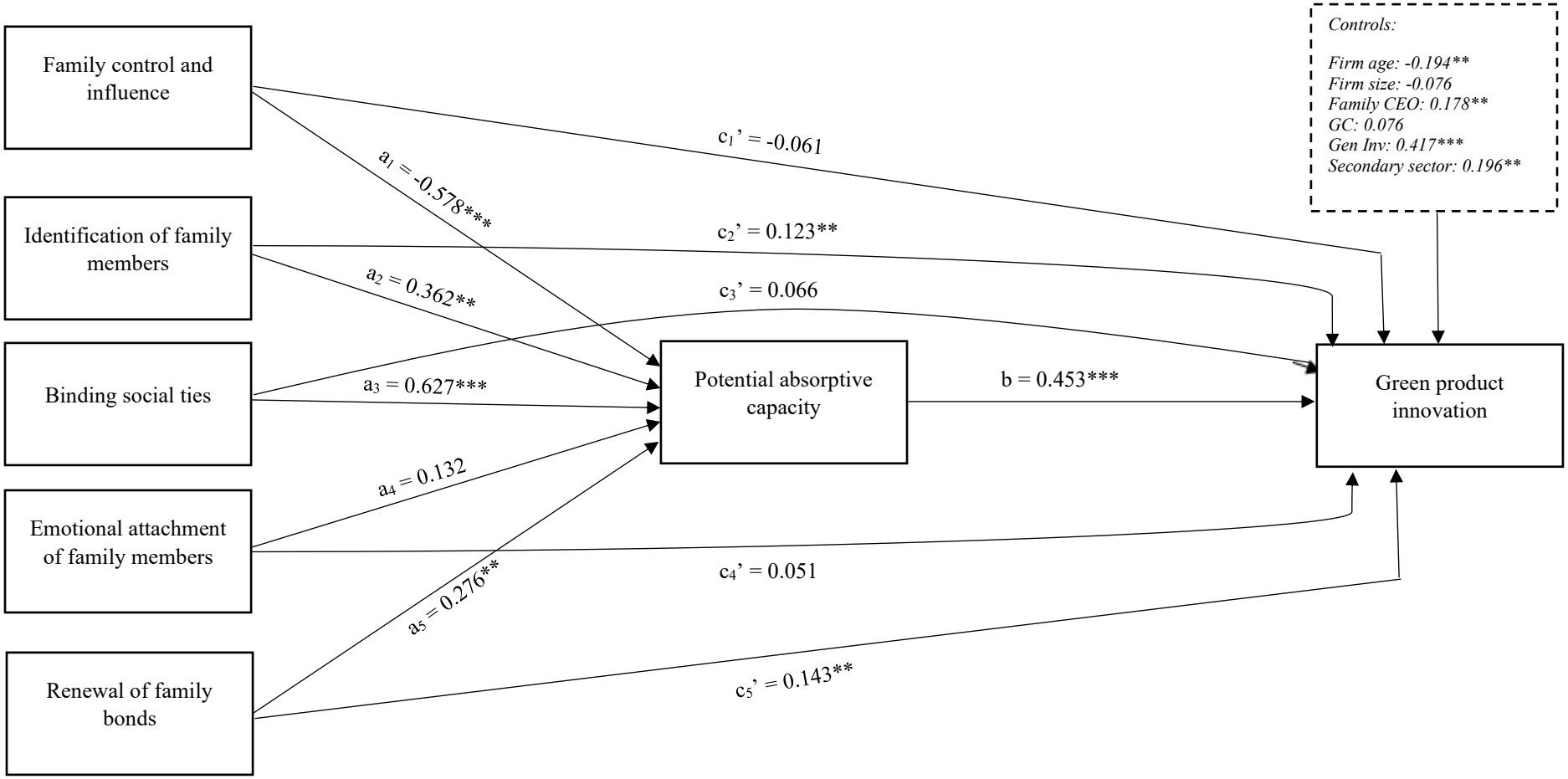

Figure 4. Results of mediated model illustrating the relationships among SEW dimensions, realized absorptive capacity and green product innovation (Model 2). The values in the figure represent standardized coefficients. Paths between indicators, latent variables, and control variables are excluded for clarity. *p < 0.100, **p < 0.050, ***p < 0.010 (one-tailed).